ECG-9320A
ECG-9320G
ECG-9320K

JC-901D
RH-933D
QI-901D
QI-902D
QM-501D
QI-911E
QI-912E
BR-911D
BR-912D
BR-913D
KD-901E
KH-801D

cardiofax V

ELECTROCARDIOGRAPH

ECG-9320

0634-001085E

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Conventions Used in This Manual and Instrument

◆Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert the reader to specific information.

WARNING

A warning alerts the user to the possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible problems with the instrument associated with its use or misuse, such as instrument malfunction, instrument failure, damage to instrument, or damage to other property.

NOTE

A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

◆Symbols

The symbols shown below are found inside the instrument. Refer to the operator's manual for other symbols found on the surface of instrument.

	Protective ground terminal		High voltage

Section 1 GENERAL

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1-1 Introduction

NOTE

- **This Service Manual covers all versions of the ECG-9320 Electrocardiograph. However, the version suffix is generally omitted in this manual unless required. Refer to the "Composition" subsection for the composition for each version of the ECG-9320 Electrocardiograph.**
- **Part of the optional hardware related to the instrument is also described in this manual. The word "optional" is omitted in most parts of this manual with the exception of the "Composition" subsection that describes the composition of the instrument. This is because each version of the ECG-9320 Electrocardiograph has a different composition. Therefore, some parts or hardware described in this manual may not apply to your instrument.**

This Service Manual is designed to provide useful information to qualified service personnel to understand, troubleshoot, service, maintain and repair the ECG-9320 Electrocardiograph and its optional hardware efficiently. All replaceable parts of this instrument and its optional hardware are clearly listed with exploded diagrams to show the location of the parts.

The section on maintenance describes only the maintenance of parts that can be performed by the qualified service personnel. Maintenance of parts that can be performed by the user is described in the Operator's Manual of the instrument.

Thoroughly read the Operator's Manual and the Service Manual of this instrument before servicing or troubleshooting the instrument.

1-2 Service Policy

Nihon Kohden basic policy for technical service is to replace the faulty printed circuit board or part with a new printed circuit board or part because most of the printed circuit boards used in this instrument employ surface mounted technology. Board-level parts replacement is not recommended outside the factory.

NOTE

When ordering parts or accessories from your nearest NK distributor, please quote the NK parts code number and the name of the parts as listed in this service manual so that we can promptly attend to your needs. Use Nihon Kohden parts and accessories to assure maximum performance from your instrument.

1-3 Specification

1. ECG input

Number of ECG input box sockets	2
ECG leads	Standard 12 lead, Cabrera lead, Nehb lead
Input circuit	Isolated and defibrillation protected
Input impedance	≧ 10 MΩ
Electrode offset tolerance	≧ ± 400 mV
CMRR	≧ 110 dB
Frequency response	0.05 to 150 Hz (−3 dB) at Drift filter set to off
Internal noise	< 20 μVpp

2. Wave data processor

Sampling rate	500 samples/s
AC line filter	50/60 Hz −40 dB, Off
High-cut filter	25, 35, 75, 100,150 Hz
Time constant	> 3.2 s
Artifact detection	Provided for each electrode except RF (N)/RL
Electrode detachment detection	Provided for each electrode except RF (N)/RL

3. External input/output

Analog input	Number of channels:	2
	Sensitivity:	10 mm/0.5 V
Analog output	Number of channels:	1
	Sensitivity:	0.5 V/1 mV
IC memory card	Standard:	according to PCMCIA Version 4.1 or more
	Number of slots:	3
Bar code reader	Interface is provided	
Communication port	Communication method:	RS-232C
	Number of ports:	1
	(Additional 2 ports optionally available)	
	baud rate: 1200, 2400, 4800, 9600	

4. Liquid crystal display (monochrome with CCFT backlight)

Size	216 mm width, 160.8 mm height
Dots	640 × 480
ECG waveform	3, 6 channel: 10 s
	12 channel: 5 s
	Rhythm lead: 20 s
Data display	Patient information, operating mode, recording settings, heat rate, QRS mark, error messages, electrode detachment, noise

5. Digital recorder

Printing method	High resolution thermal printer head	
Printing density	Horizontal:	40 dots/mm at 25 mm/s
	Vertical:	8 dots/mm
Recording width	ECG-9320A:	216 mm
	ECG-9320K/G:	210 mm
Number of recording channels	3, 4, 6, 12	
Recording sensitivity	2.5, 5, 10, 20 mm/mV ± 5 %	
Paper speed	5, 10, 12.5, 25, 50 mm	
Data record	Model, program name, version, date, time, paper speed, sensitivity, lead name, used filters, hospital name, patient information	

6. Power requirement

Line voltage	ECG-9320A:	115 to 127 V AC ± 10%
	ECG-9320G:	230 VAC ±10%
	ECG-9320K:	110, 115 to 127, 220 to 240 VAC ±10%
Line frequency	50 or 60 Hz	
Power input	180 VA	

7. Environment

Operating temperature	10 to 40 °C
Operating humidity	25 to 95 % RH (25 to 80 % RH when recording paper is used)
Storage temperature	−15 to 40 °C
Storage humidity	15 to 95 % RH
Atmospheric pressure	70 to 106 kPa

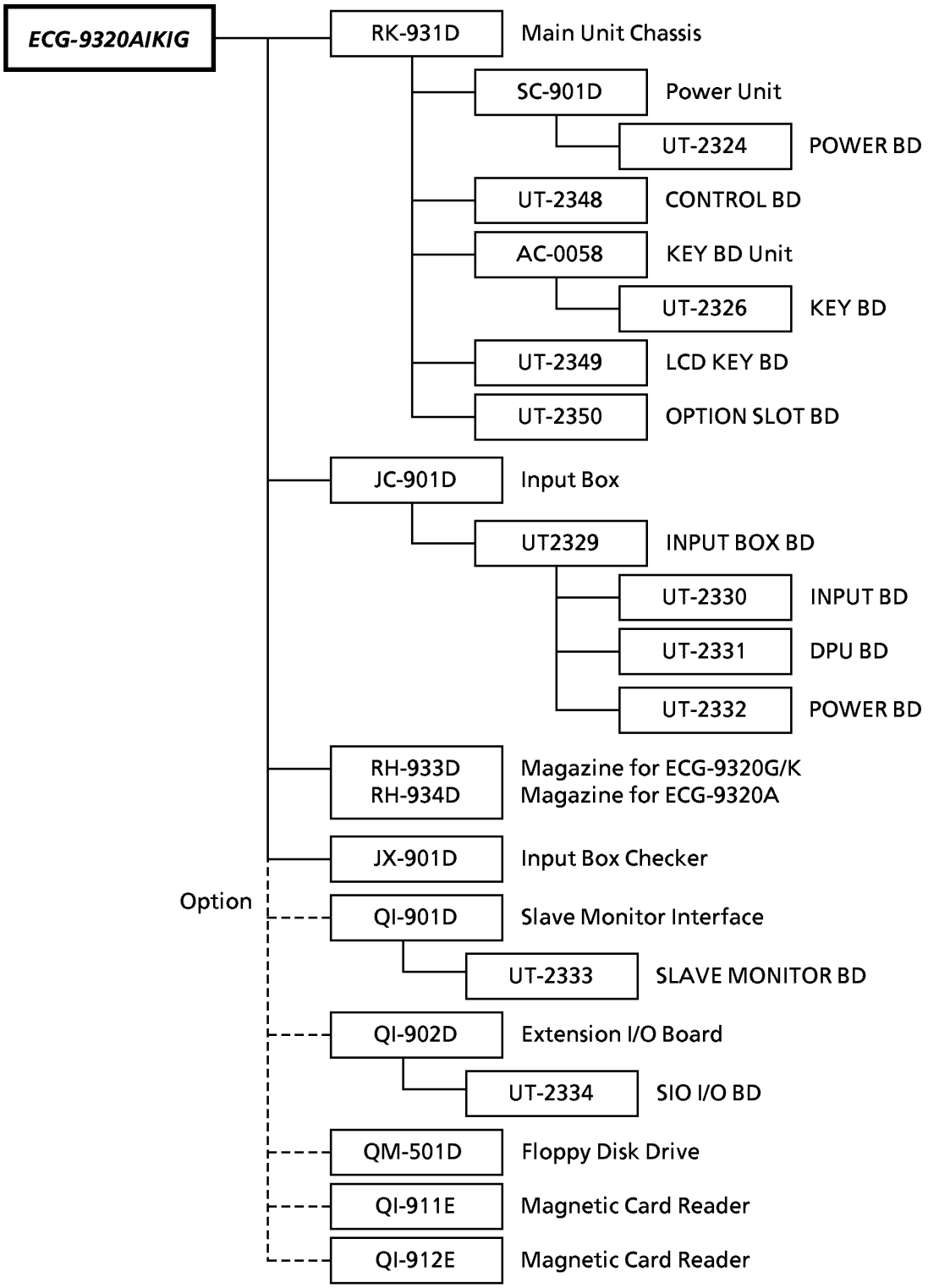
8. Dimensions and weight

Dimensions	425 W × 173 H × 400 D mm
Weight	13.8 kg

9. Safety

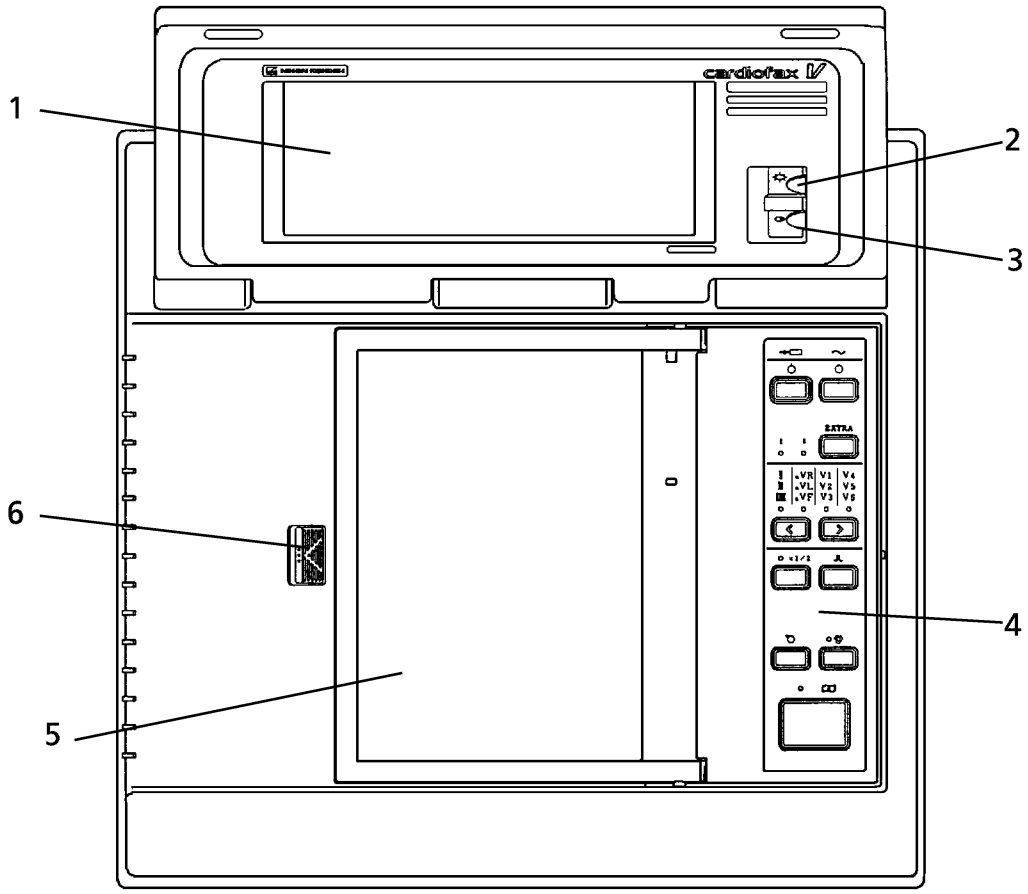
Safety standard	IEC601-1, IEC601-2-25
Type of protection against electrical shock	AC power: Class I Battery power: Internally powered equipment
Degree of protection electrical shock	DEFIBRILLATION-PROOF, Type CF applied part
Degree of protection against harmful ingress of water	Ordinary equipment
Degree of safety of application in the presence of a flammable anaesthetic mixture with air, oxygen or nitrous oxide	Equipment not suitable for use in the presence of flammable anaesthetic mixture with air, oxygen or nitrous oxide
Mode of operation	Continuous
Chassis leakage current	≦0.1 mA
Patient leakage current I	≦ 0.01 mA
Patient leakage current III	≦ 0.05 mA
Patient auxiliary current	≦ 0.01 mA
1500 V across primary and chassis 4000 V across patient circuit and primary for 1 minute	

1-4 Composition



1-5 Panel Explanation

1-5-1 Top View



1 LCD touch-screen

2 LCD Brightness control

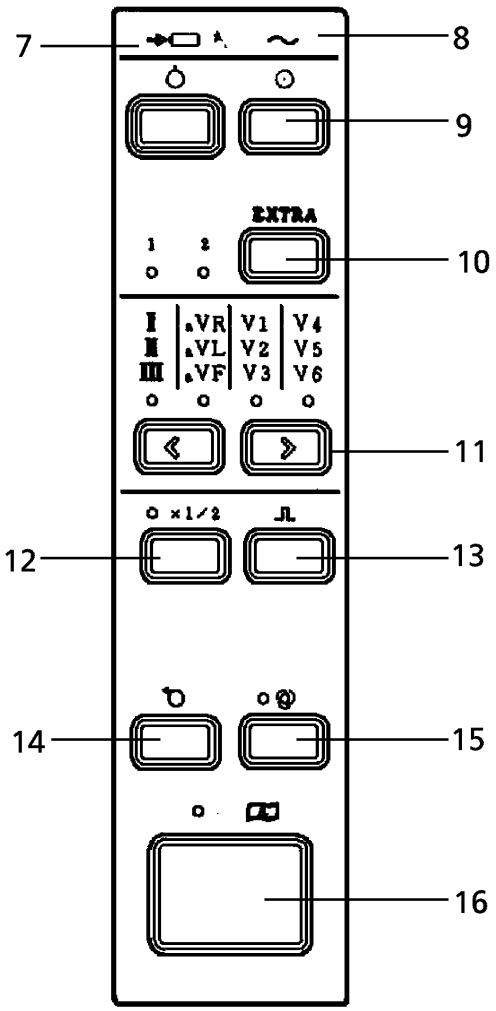
3 LCD Contrast control

4 Operation panel

5 Magazine

6 Magazine release lever

1-5-2 Operation Panel



7 Battery charge lamp

8 AC power lamp

9 Power switch

10 Extra switch /lamp

11 Lead selection switch/lamp

12 Sensitivity ×1/2 switch

13 Calibration switch

14 Paper feed switch

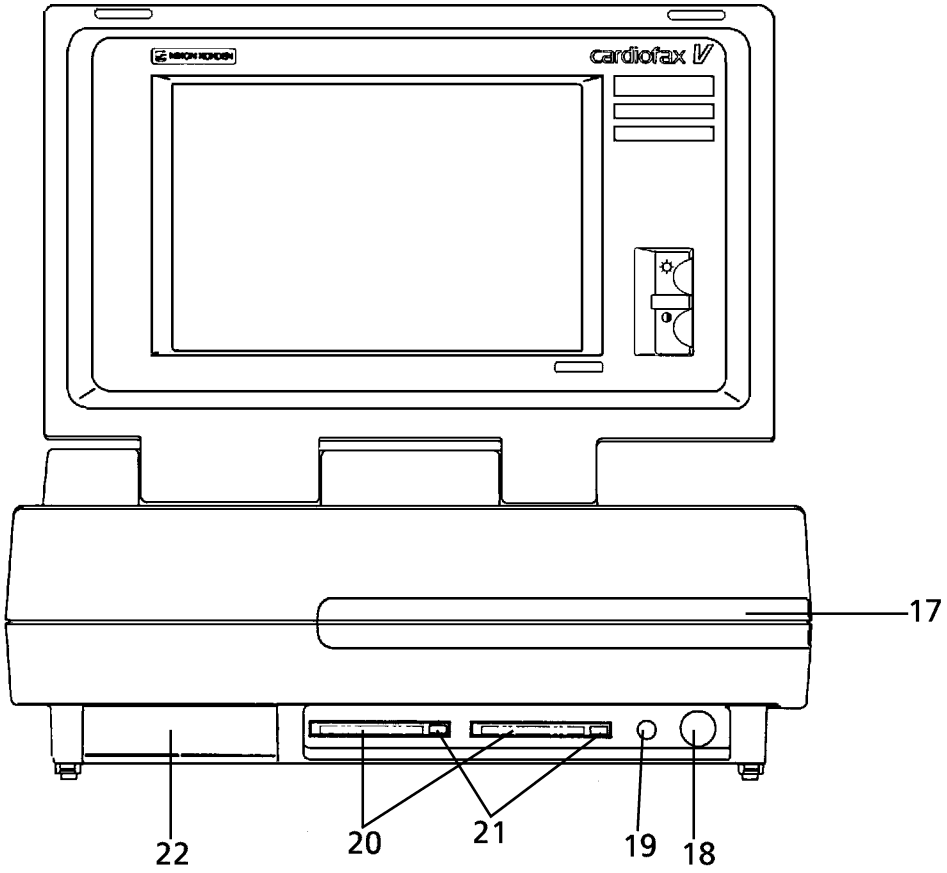
15 Auto/manual selection switch/lamp

16 Start/Stop switch/lamp

1-5-3 Front Panel

CAUTION

When connecting an external instrument to the following connectors or sockets with an "*" mark, ensure that the external instrument complies with the IEC601-1, IEC601-2-25 safety standard for medical equipment. When connecting an instrument that does not comply with IEC601-1, IEC601-2-25, such as a personal computer or modem, etc., use a locally available medical use isolation transformer unit between the instrument and the AC outlet.



17 Optional magnetic card reader slot

18 ECG input box socket B ⚠

19 External signal input socket* ⚠

20 IC memory card slot 1 ⚠
IC memory card slot 2 ⚠

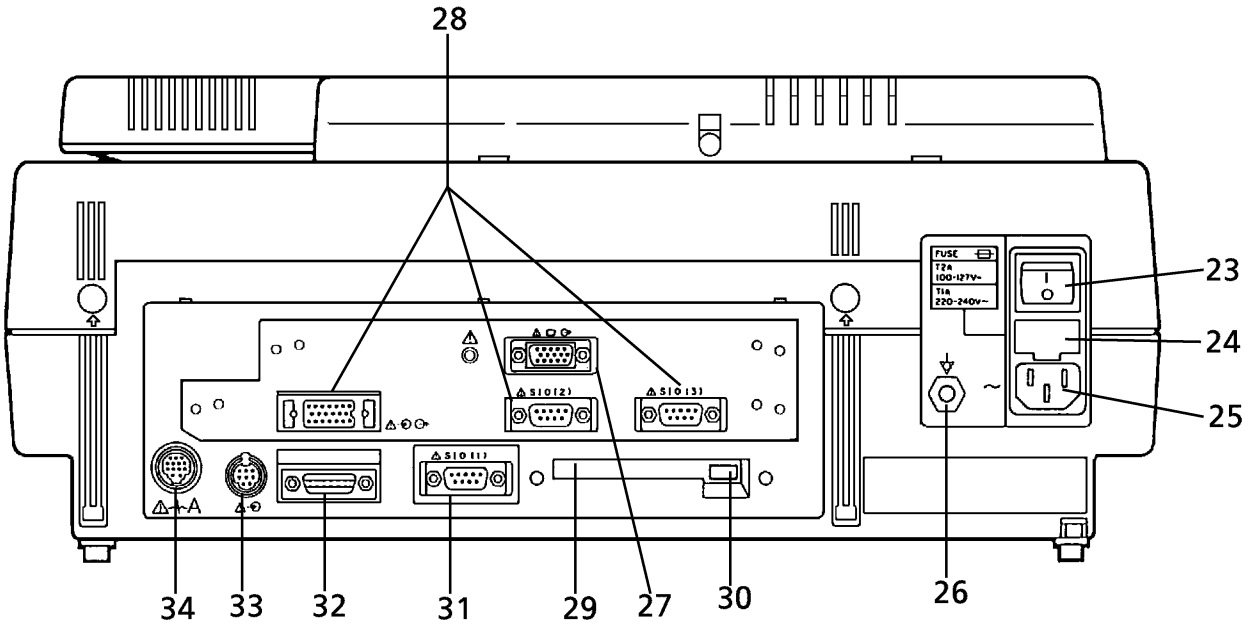
21 Eject button

22 Optional 3.5 inch floppy disk drive

1-5-4 Rear Panel

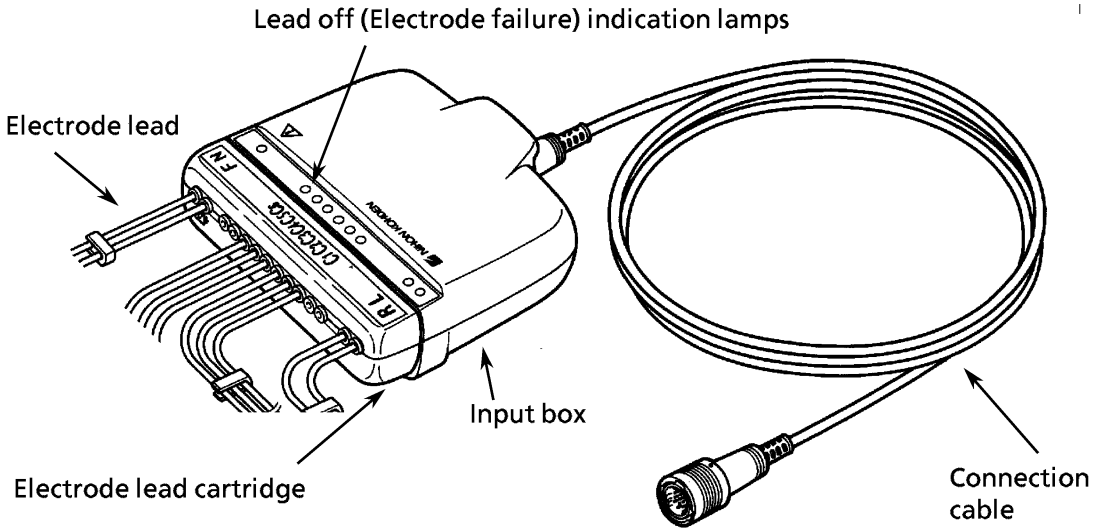
CAUTION

When connecting an external instrument to the following connectors or sockets with an "*" mark, ensure that the external instrument complies with the IEC601-1, IEC601-2-25 safety standard for medical equipment. When connecting an instrument that does not comply with IEC601-1, IEC601-2-25, such as a personal computer or modem, etc., use a locally available medical use isolation transformer unit between the instrument and the AC outlet.



23	Main power switch	29	IC memory card slot 3 ⚠
34	Fuse compartment	30	Eject button
25	AC Source	31	SIO socket 1* ⚠
26	Equipotential ground terminal	32	External input/output socket* ⚠
27	Slave monitor interface board socket* ⚠	33	Bar code reader socket ⚠
28	Extension I/O board sockets* ⚠	34	Input box socket A ⚠

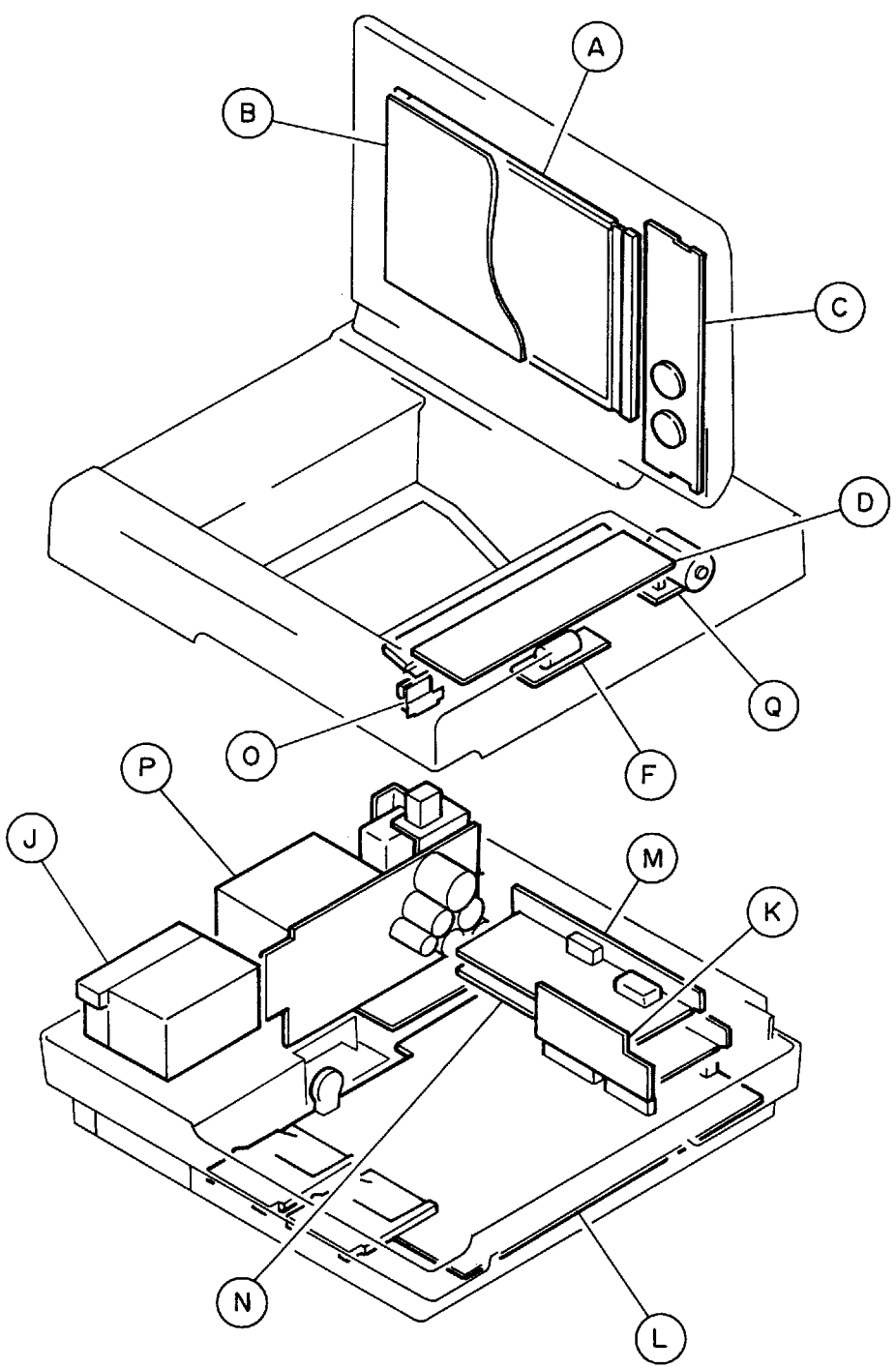
1-5-5 Input Box Set



Input Box Set BJ-911D

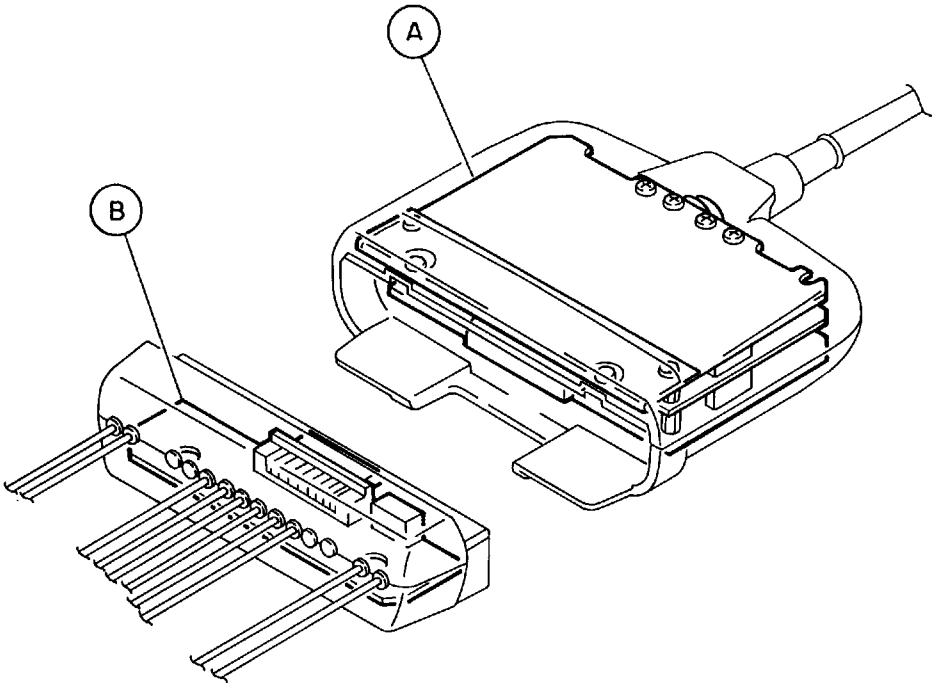
1-6 Location

1-6-1 Main Unit



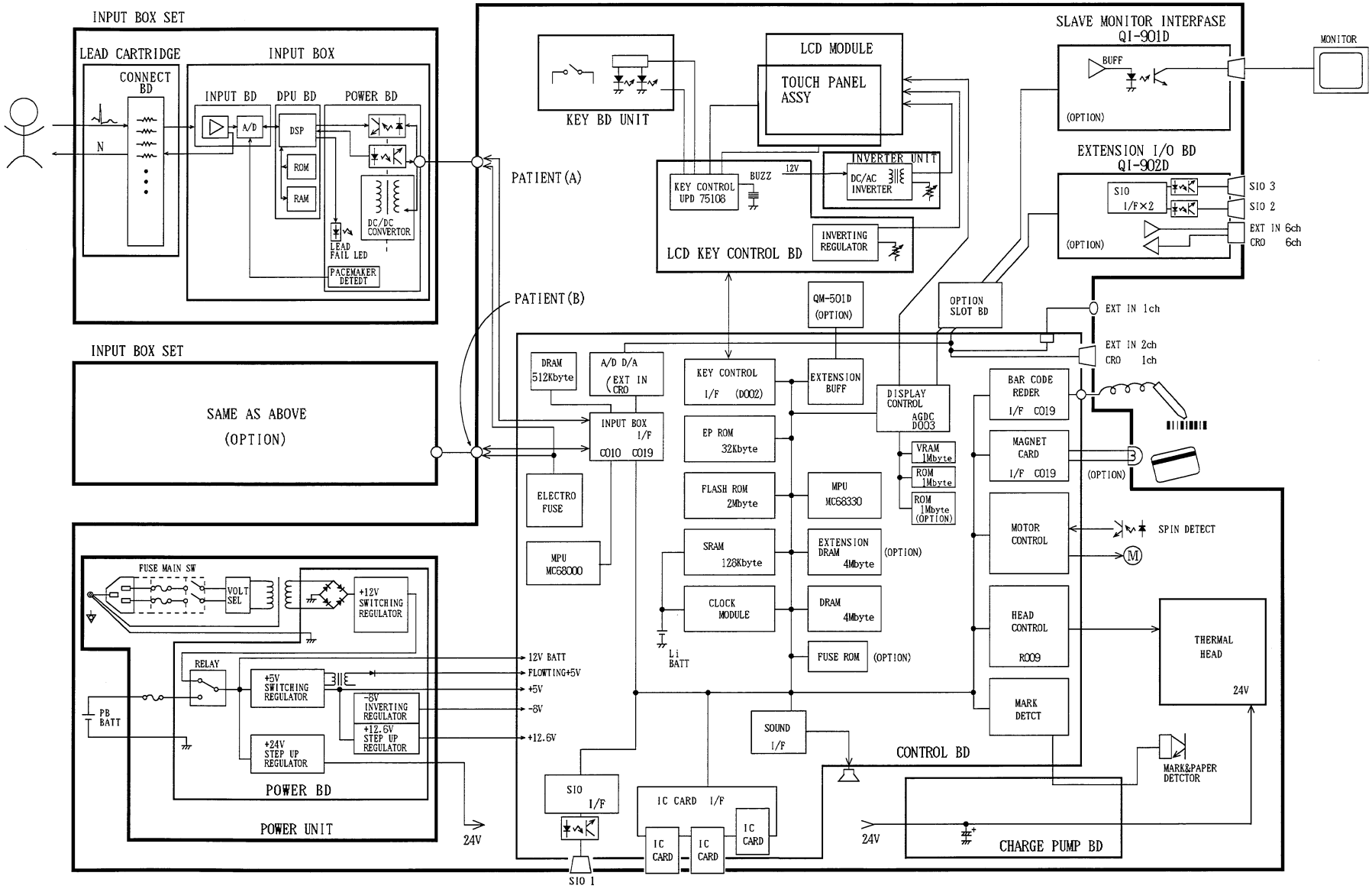
Ⓐ LCD Module
Ⓑ Touch Panel ASSY
Ⓒ LCD KEY BD
Ⓓ KEY BD
Ⓕ CHARGE PUMP BD
Ⓙ Battery
Ⓚ OPTION SLOT BD
Ⓛ CONTROL BD
Ⓜ Slave Monitor Interface
Ⓝ Extension I/O Board
Ⓞ PAPER SENSORS ASSY
Ⓟ Power Unit
Ⓠ Motor ASSY

1-6-2 Input Box



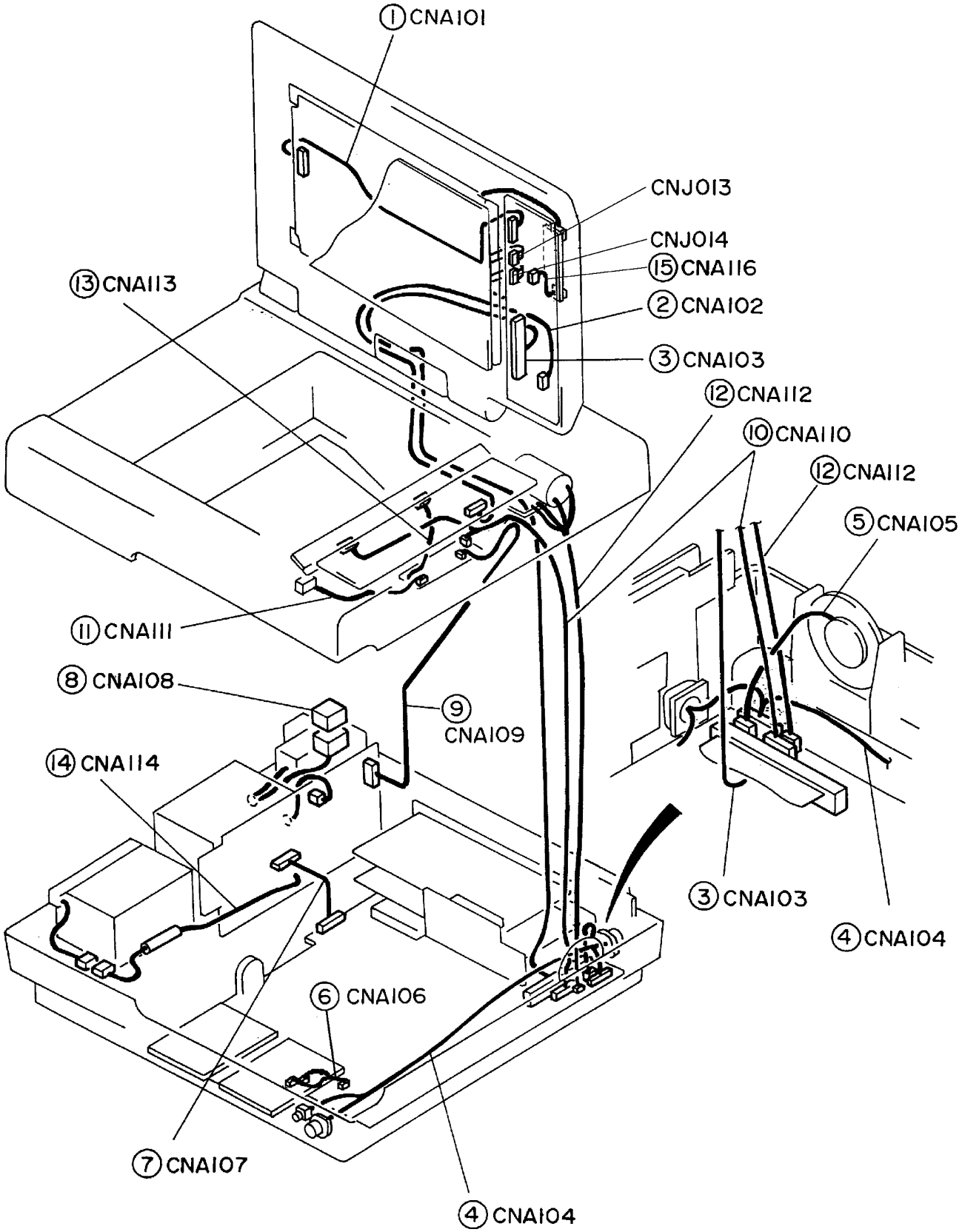
Ⓐ INPUT BOX BD
Ⓑ CONNECT BD

1-7 Block Diagram



1-8 Connection Diagram

Index	Connector No.	NK Parts No.	Description
1	CNA101	444788B	51004-1500/51021-1500 (LCD-LCD)
2	CNA102	443192C	DF11-20DS-2C (LCD-KEY) L=1050W
3	CNA103	443343B	FCN-607D060-G/D (CONT-LCD)
4	CNA104	YZ-025D8	INPUT-CONT ASSY
5	CNA105	YZ-025D9	Speaker ASSY
6	CNA106	443316	CONT-CARD ASSY
7	CNA107	443299A	DF11-28DS-2C (POWER-CONT)
8	CNA108	427735	1-480706 V-SEL Assy 110V
		427744	1-480706 V-SEL Assy 115 - 127V
		427753	1-480706 V-SEL Assy 220 - 240V
9	CNA109	444797B	DF11-16DS-2C (POWER-CHG)
10	CNA110	443165A	CONT-HEAD ASSY
11	CNA111	YZ-026D6	Paper sensors ASSY
12	CNA112	443263B	DF11-8DS-2C (CONT-MOT)
13	CNA113	444814	PHR-4 (CHG-HEAD)
14	CNA114	443183	Battery cable ASSY
15	CNA116	526931	51021-0500 L=55 MM


①CNA101
CNJ013
CNJ014
⑮CNA116
⑬CNA113
②CNA102
③CNA103
⑫CNA112
⑩CNA110
⑫CNA112
⑤CNA105
⑪CNA111
⑧CNA108
⑨
CNA109
⑭CNA114
③CNA103
④CNA104
⑥CNA106
⑦CNA107
④CNA104

1-9 Determining the Amplitude Frequency Characteristic

Use this procedure to determine the amplitude frequency characteristic of the instrument.

Procedure

1. Connect the input box set to the instrument.

2. Connect a sine signal generator to the electrode leads of the input box set.

Electrode Leads to Sine Signal Generator Combination Table

Combination	+ terminal	– terminal
1	R(RA)	L(LA), F(LL) and N(RL)
2	L(LA)	R(RA), F(LL) and N(RL)
3	F(LL)	R(RA), L(LA) and N(RL)
4	C1(V1)	R(RA), L(LA), F(LL) and RF(RL)
5	C2(V2)	R(RA), L(LA), F(LL) and RF(RL)
6	C3(V3)	R(RA), L(LA), F(LL) and RF(RL)
7	C4(V4)	R(RA), L(LA), F(LL) and RF(RL)
8	C5(V5)	R(RA), L(LA), F(LL) and RF(RL)
9	C6(V6)	R(RA), L(LA), F(LL) and RF(RL)

3. Set the sine signal generator to output a 1 mV sine wave at a frequency of 10 Hz.

4. Switch on the instrument.

5. Press the Start switch to start printing the sine wave.

6. Repeat steps 3 through 5 for 1mmV sine wave with 0.5 Hz and 150 Hz.

7. Repeat steps 2 through 8 for all the combinations listed in the table in step 2.

8. Check that the amplitudes of the printed 0.5 Hz and 150 Hz sinusoidal waves for all the combination listed in the table in step 2 are within the range listed in the table below.

Input Frequency (Hz)	Acceptable Range in %
10	100% (this amplitude is used as the 100% reference)
0.5	90 to 105%
150	71 to 105%

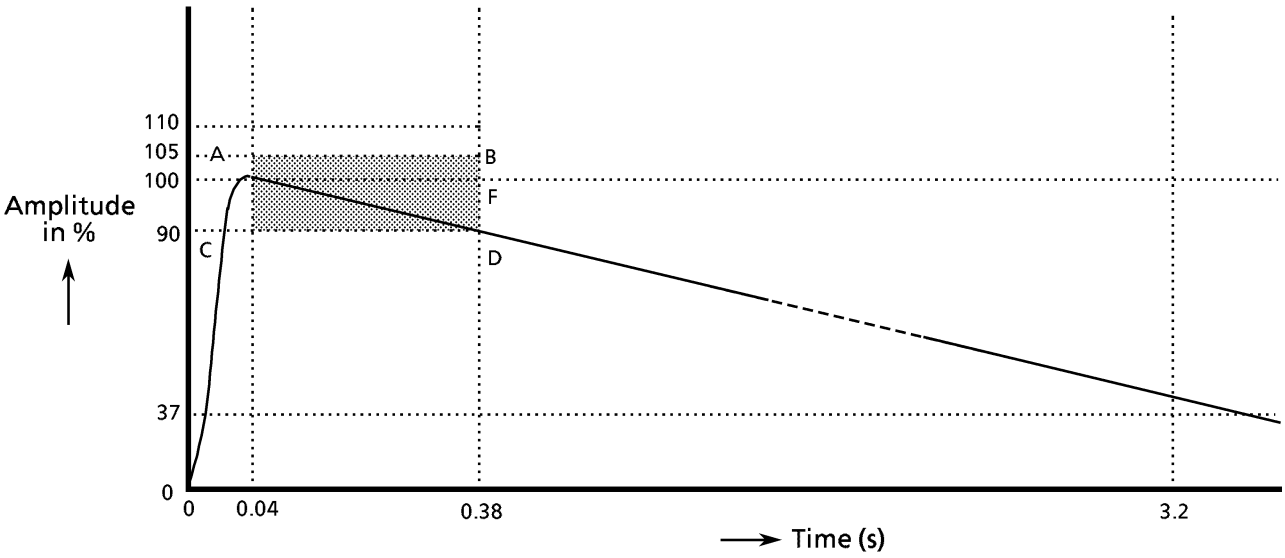
9. If the amplitude of the sine wave for any combination, for either 0.5 Hz or 150 Hz, is out of the above range, contact your nearest NK distributor.

1-10 Determining the Low Frequency Response

The low frequency response of the instrument allows the recording and measurement of low frequency components of an ECG. This instrument is designed to give a decay of the recorded amplitude after the positive edge of the pulse within the first 360 milliseconds shall not exceed that produced by a system with a time constant of 3.2 seconds.

◆Determination Method

The low frequency response range is determine by using the graph below.



Low Frequency Response of a Calibration Signal

The graph shows the instrument's output of a 1 mV calibration signal. The amplitude of the of the rising wave at 0.04 second is taken as the 100% amplitude point. From this 100% amplitude point, the 105% and 90% amplitude level is determined. Point A and C are points on 105% and 90% amplitude levels at 0.04 second. Point B and D are points on 105% and 90% amplitude levels at 0.38 second. The area ABCD is the low frequency response range for the instrument. The instrument does not meet specifications if the output signal is out of this low frequency response range. The instrument also does not meet its intended specifications if any rising signal overshoots the 110% amplitude level within 0.04 second.

◆**Procedure**

1. Connect the input box set to the instrument.

2. Connect the R electrode lead to the + terminal of the function generator and the L, F and RF electrode leads to the − terminal of the function generator.

3. Set the function generator to output a 1 mV single-shot rectangular wave. The single-shot rectangular wave must have a duration of 0.5 seconds.

4. Turn on the instrument.

5. Press the Setup key to call up the Standard 12-lead setup menu window.

6. Press the Manual Recording key to call up the Manual Recording menu window.

7. Press the Auto Position key to set the mode to OFF.

NOTE

Remember to set the Auto Position mode to its original setting after completing this test.

8. Return to the normal monitoring screen.

9. Press the Start switch to start printing.

10. Trigger the function generator to output 1 mV single-shot rectangular waves having a duration of 0.5 seconds.

11. From the printed output, determine the 100% amplitude point by using the method described above.

12. Plot the area ABCD.

13. Contact your nearest NK distributor if the low frequency response is out of the area ABCD.

Section 2 MAINTENANCE

2-1 Replacement 2.1
2-1-1 Periodically Replacement Schedule 2.1
2-2 Cleaning 2.2
2-2-1 Cleaning Schedule 2.2
2-2-2 Cleaning Paper Detection Mark Sensor and Paper Empty Sensor 2.3
2-2-3 Cleaning Motor Rotation Sensor 2.4

This section describes the periodic replacement and cleaning of parts which is required to maintain the instrument in good working condition.

2-1 Replacement

This subsection only describes replacement schedule for parts that need to be periodically replaced. The actual replacement procedures are described in the section for Disassembly and Assembly. Read the whole "Disassembly and Assembly" section, especially its Warnings and Cautions, before replacing of any of the parts described here.

2-1-1 Periodically Replacement Schedule

To maintain the performance of the instrument, the parts listed in the table below must be periodically replaced by qualified service personnel.

Part	NK Parts Code	Description	Recommendation
CR 2450	481809	Lithium battery	After 3 years
LC-S2912NK	442843	Battery	* See below.
KJT-216-8MPF1-NK	357035	Thermal head	After 30 km of recording
LRUGB6121A	518468	LCD Module	After 25000 hours
9000 Motor ASSY	YZ-026D1	Motor ASSY	After 1000 hours

* Replace the battery when it cannot last for 30 minutes during battery operation.

2-2 Cleaning

This subsection describes the cleaning procedures for parts that must be cleaned by qualified service personnel. The cleaning procedures for parts that can be cleaned by the user are described in the Operator's Manual.

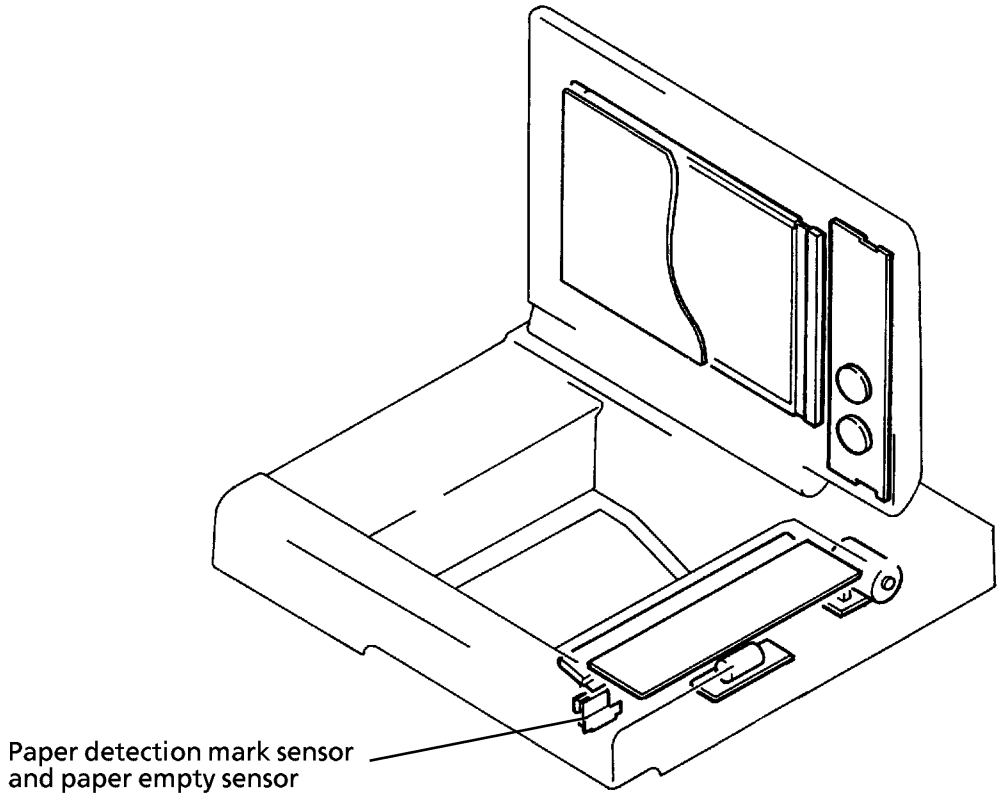
2-2-1 Cleaning Schedule

To maintain the performance of the instrument, the parts listed in the table below must be regularly cleaned.

Part	Frequency	Perform by
Instrument (external)	After use	User
Thermal Head	1 time a month	User
Platen Roller ASSY	1 time a year	User
Paper Mark Detection Sensor	1 time a month	Qualified service personnel
Paper Empty Sensor	1 time a month	Qualified service personnel
Motor sensor	1 time a year	Qualified service personnel

2-2-2 Cleaning Paper Detection Mark Sensor and Paper Empty Sensor

1. Remove the magazine. The illustration below shows the location of the paper detection mark sensor and paper empty sensor.

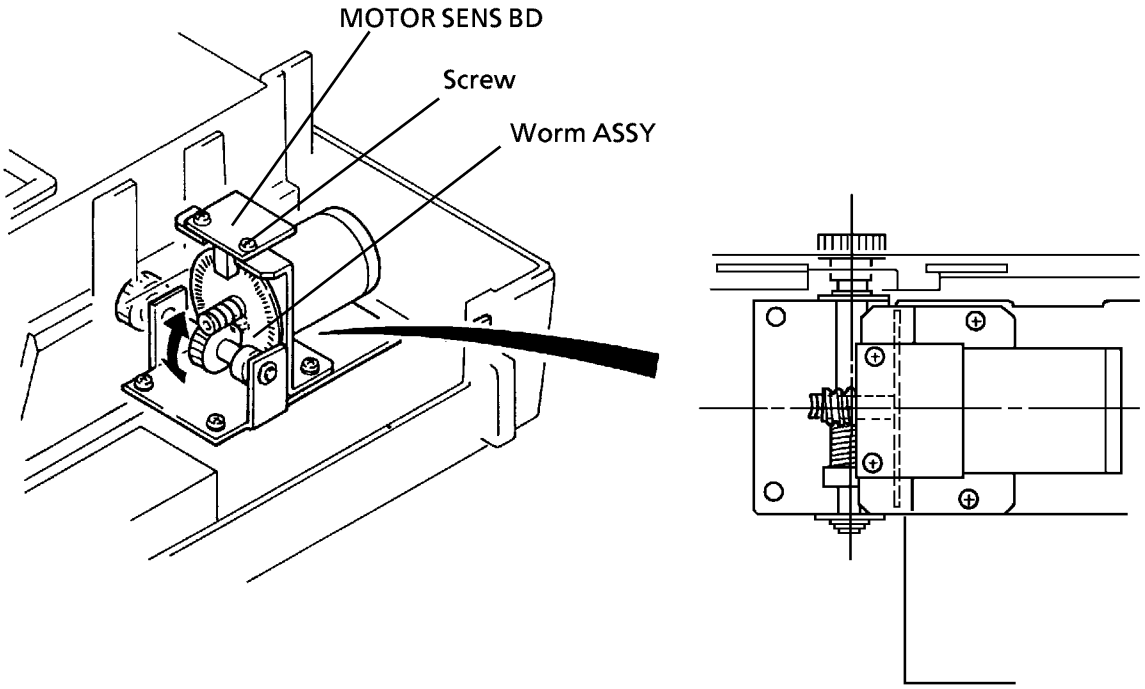


2. Use a piece of cotton moistened with alcohol to clean both sensors.

2-2-3 Cleaning Motor Rotation Sensor

1. Detach the top casing from the bottom casing as described in the "Disassembly and Assembly" section.

2. Remove the two screws that attach the MOTOR SENS BD to the motor.



3. Turn the MOTOR SENS BD over to expose the photo-diode and sensor.

4. Use a piece of cotton moistened with alcohol to clean the photo-diode and sensor.

5. Use a brush to clean the holes in the worm-gear.

6. Reattach the MOTOR SENS BD to the motor with the two screws.

7. Reattach the top casing to the bottom casing as described in the "Disassembly and Assembly" section.

Section 3 TROUBLESHOOTING AND SYSTEM ERROR MESSAGE

3-1 Troubleshooting Flowchart 3.1
3-2 Troubleshooting Table 3.7
3-2-1 Troubleshooting General Operation Problem 3.7
3-2-2 Troubleshooting Recording Problem 3.9
3-2-3 Troubleshooting Fuse Problem 3.11
3-3 Troubleshooting the POWER BD 3.12
3-4 Troubleshooting the Electrode Leads Cartridge 3.14
3-5 System Error Message 3.15
3-6 Input Box Error 3.17

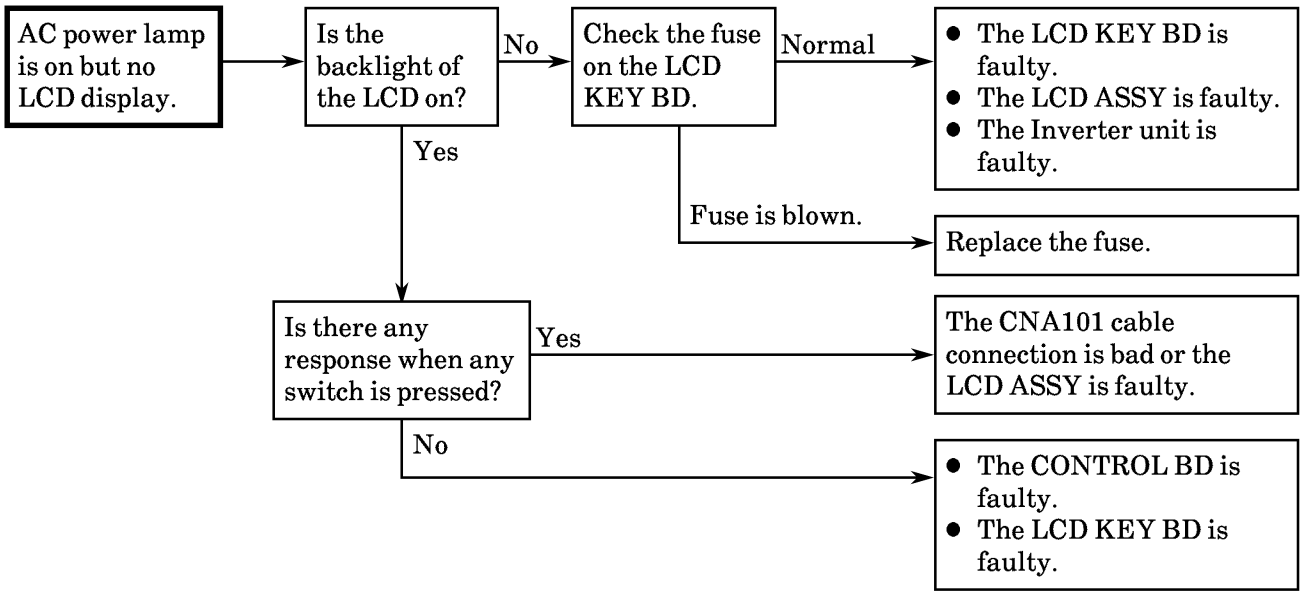
This section describes the methods used to troubleshoot the instrument when a problem occurs.

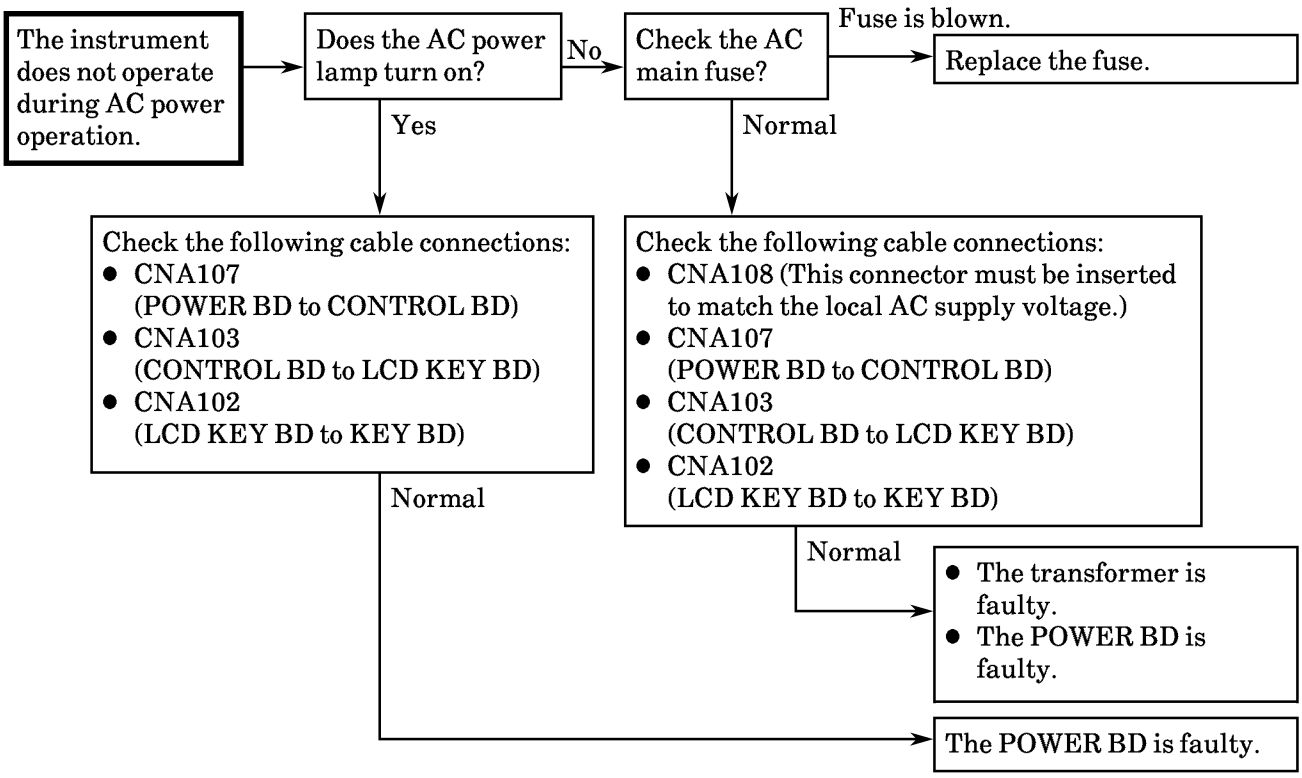
Section 3-1: Describes the troubleshooting method using a flowchart.
Section 3-2: Describes the troubleshooting method using a troubleshooting table.
Section 3-3: Describes the method used to troubleshoot the POWER BD.
Section 3-4: Describes the method used to troubleshoot the electrode leads cartridge.
Section 3-5: Describes the system information message when a hardware or software failure is detected during power-up.

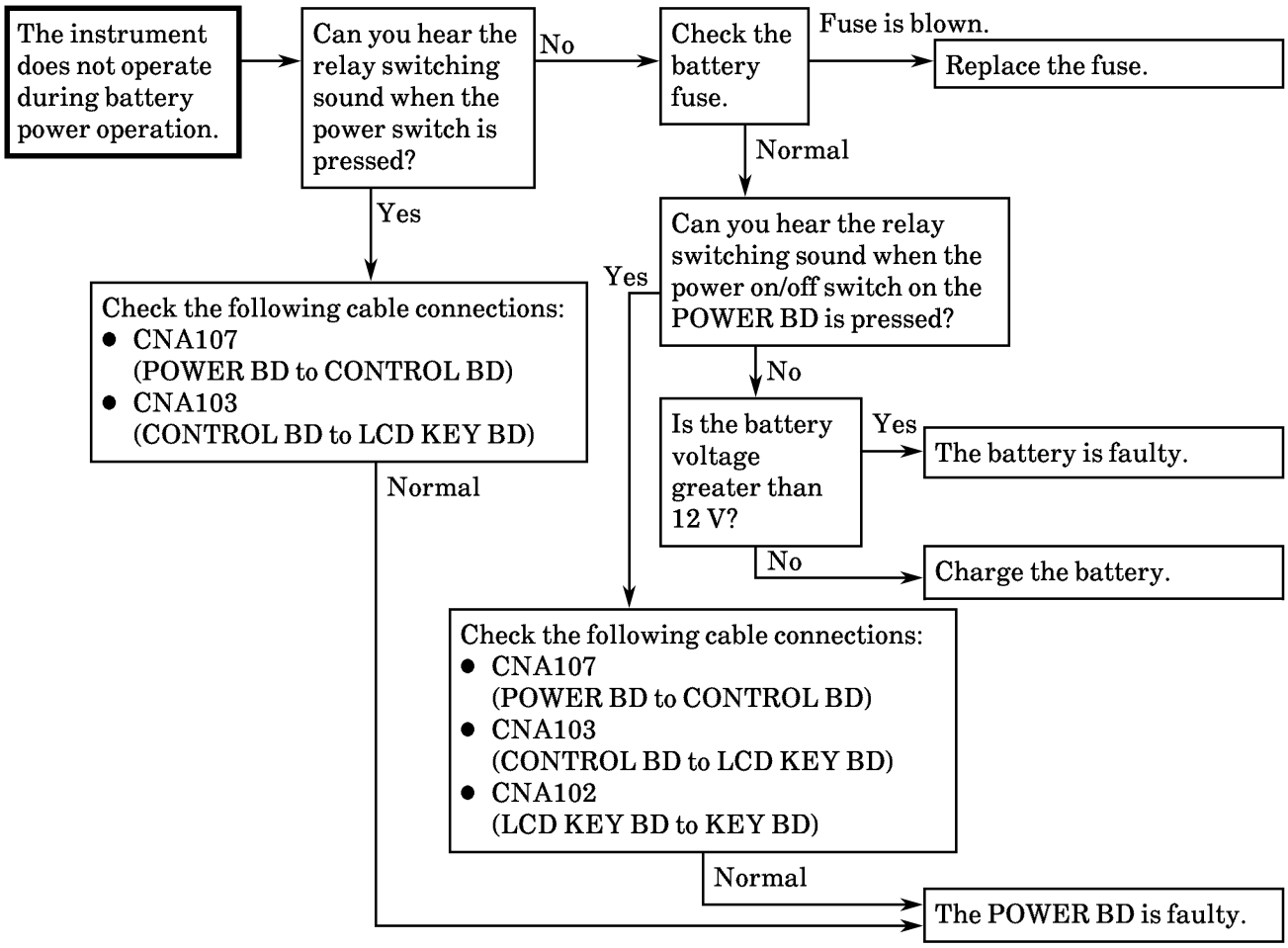
3-1 Troubleshooting Flowchart

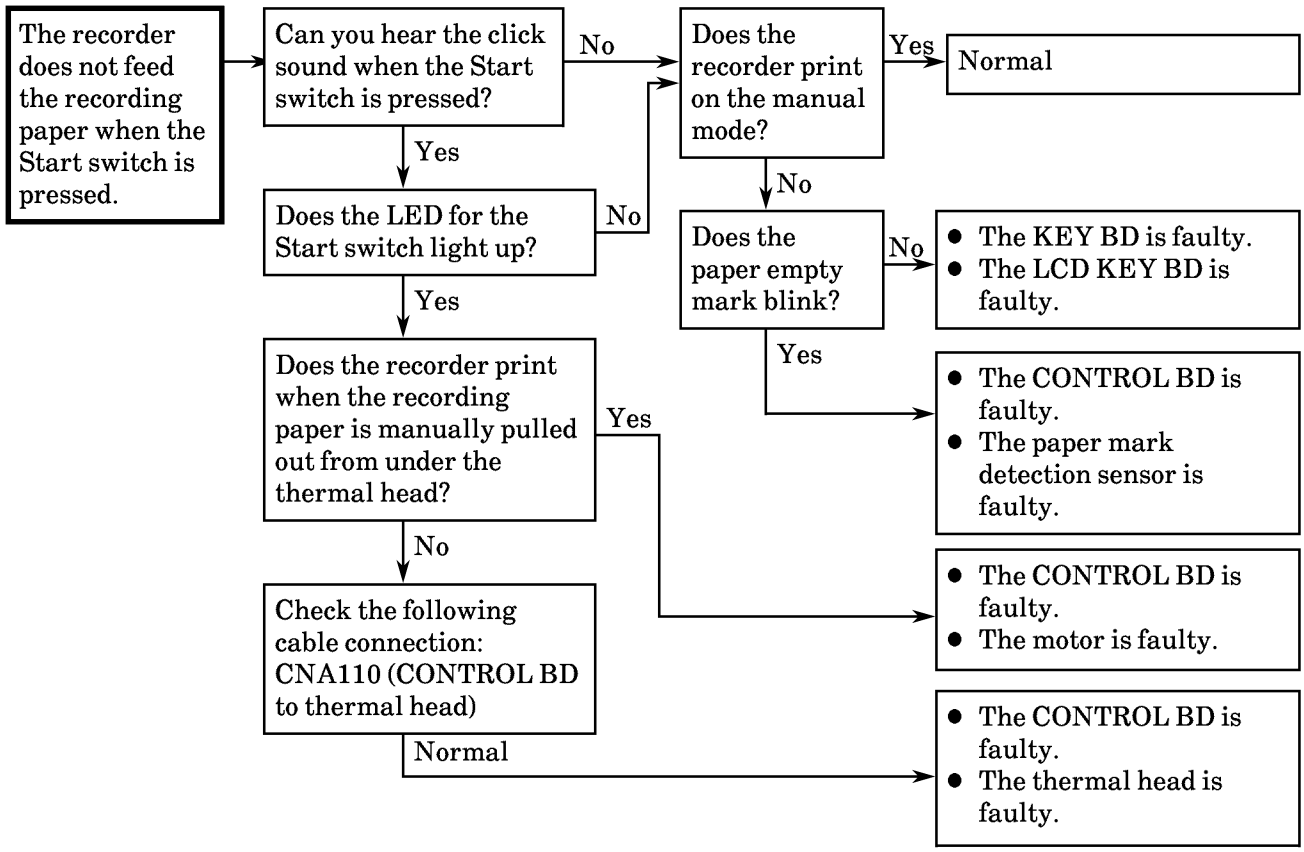
The troubleshooting flowchart is a troubleshooting method that narrows down the possible sources of the problem through a few progressive steps. Each of these progressive steps depends on the outcome of the earlier step.

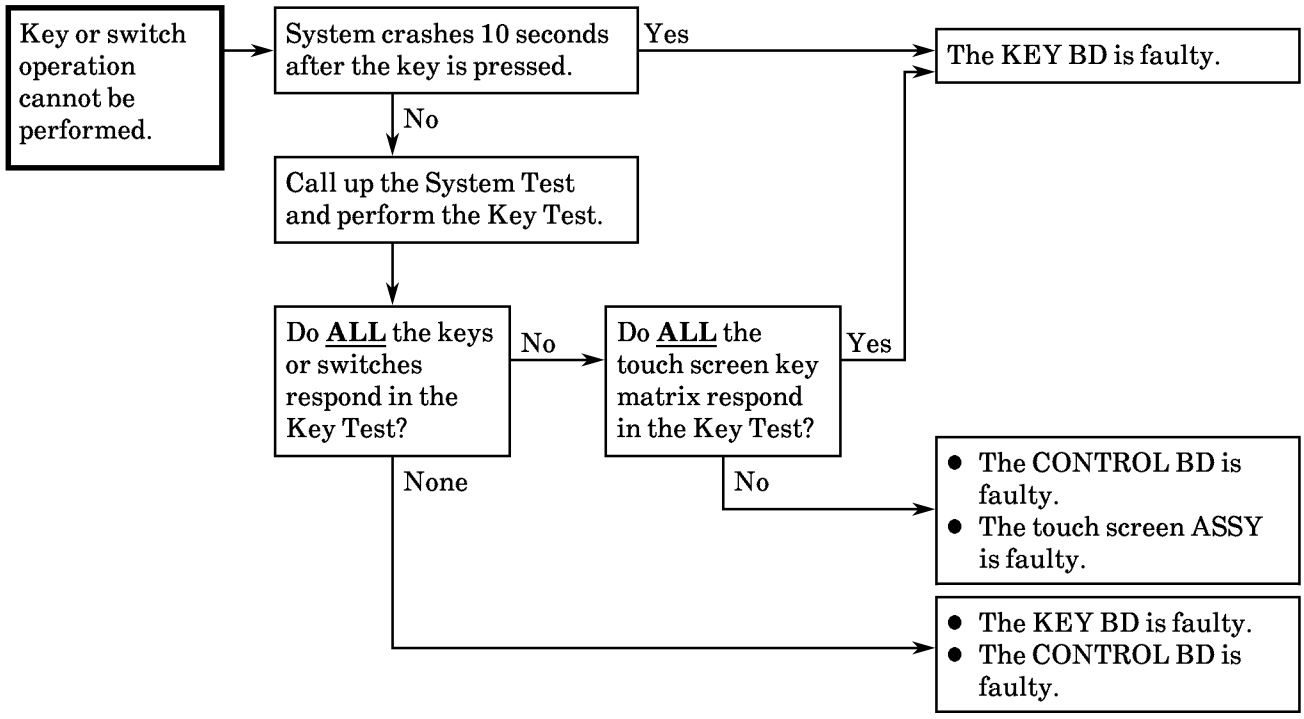
Troubleshooting Flowchart

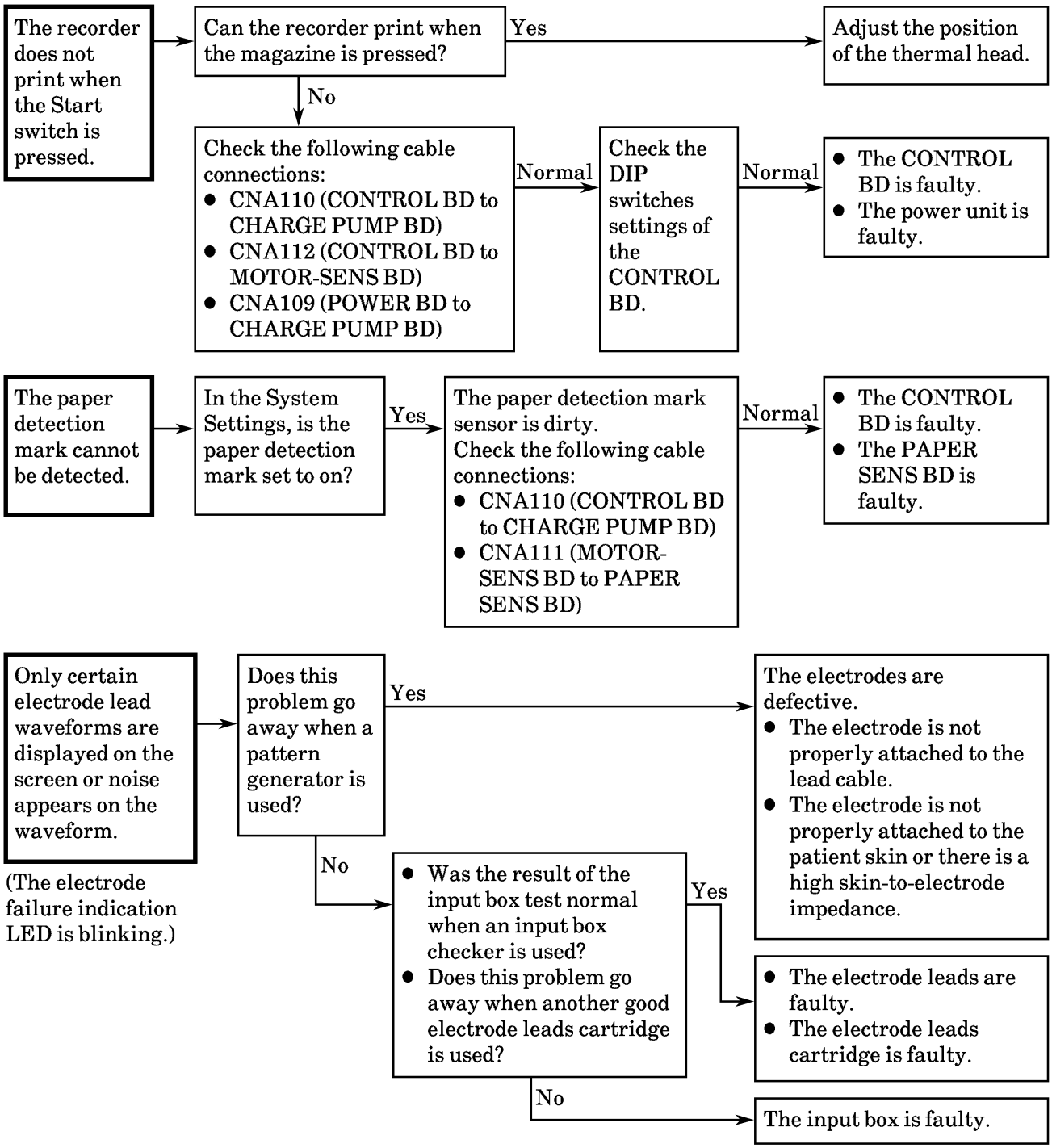

AC power lamp is on but no LCD display.
Is the backlight of the LCD on?
No
Check the fuse on the LCD KEY BD.
Normal
• The LCD KEY BD is faulty.
• The LCD ASSY is faulty.
• The Inverter unit is faulty.
Yes
Fuse is blown.
Replace the fuse.
Is there any response when any switch is pressed?
Yes
The CNA101 cable connection is bad or the LCD ASSY is faulty.
No
• The CONTROL BD is faulty.
• The LCD KEY BD is faulty.

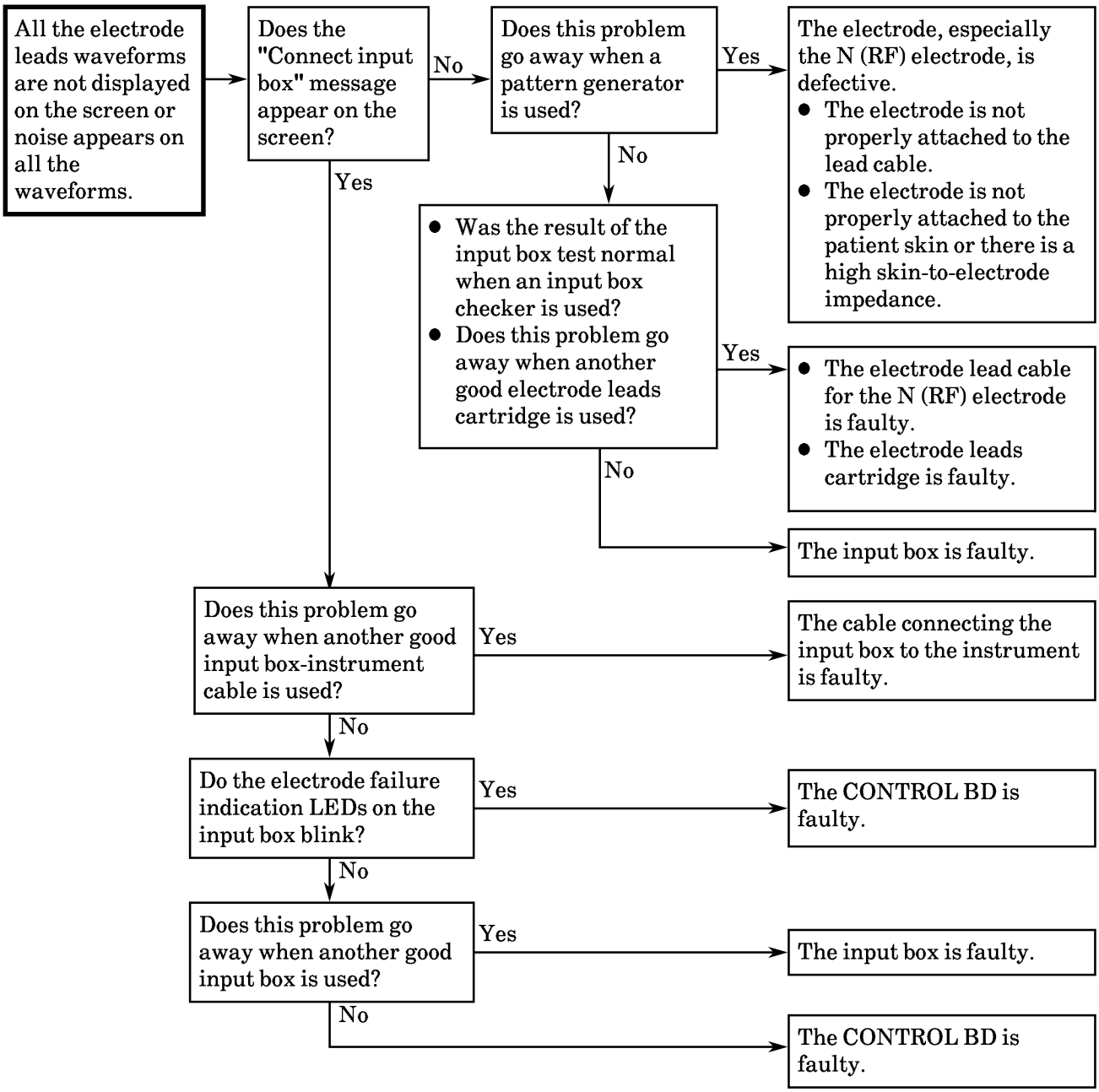

The instrument does not operate during AC power operation.
Does the AC power lamp turn on?
No
Check the AC main fuse?
Fuse is blown.
Replace the fuse.
Yes
Normal
Check the following cable connections:
● CNA107 (POWER BD to CONTROL BD)
● CNA103 (CONTROL BD to LCD KEY BD)
● CNA102 (LCD KEY BD to KEY BD)
Check the following cable connections:
● CNA108 (This connector must be inserted to match the local AC supply voltage.)
● CNA107 (POWER BD to CONTROL BD)
● CNA103 (CONTROL BD to LCD KEY BD)
● CNA102 (LCD KEY BD to KEY BD)
Normal
Normal
● The transformer is faulty.
● The POWER BD is faulty.
The POWER BD is faulty.


The instrument does not operate during battery power operation.
Can you hear the relay switching sound when the power switch is pressed?
No
Check the battery fuse.
Fuse is blown.
Replace the fuse.
Normal
Yes
Can you hear the relay switching sound when the power on/off switch on the POWER BD is pressed?
Yes
Check the following cable connections:
• CNA107 (POWER BD to CONTROL BD)
• CNA103 (CONTROL BD to LCD KEY BD)
No
Is the battery voltage greater than 12 V?
Yes
The battery is faulty.
Normal
No
Charge the battery.
Check the following cable connections:
• CNA107 (POWER BD to CONTROL BD)
• CNA103 (CONTROL BD to LCD KEY BD)
• CNA102 (LCD KEY BD to KEY BD)
Normal
The POWER BD is faulty.


The recorder does not feed the recording paper when the Start switch is pressed.
Can you hear the click sound when the Start switch is pressed?
No
Yes
Does the LED for the Start switch light up?
No
Yes
Does the recorder print when the recording paper is manually pulled out from under the thermal head?
Yes
No
Check the following cable connection: CNA110 (CONTROL BD to thermal head)
Normal
Does the recorder print on the manual mode?
Yes
Normal
No
Does the paper empty mark blink?
No
The KEY BD is faulty.
The LCD KEY BD is faulty.
Yes
The CONTROL BD is faulty.
The paper mark detection sensor is faulty.
The CONTROL BD is faulty.
The motor is faulty.
The CONTROL BD is faulty.
The thermal head is faulty.


Key or switch operation cannot be performed.
System crashes 10 seconds after the key is pressed.
Yes
The KEY BD is faulty.
No
Call up the System Test and perform the Key Test.
Do ALL the keys or switches respond in the Key Test?
No
Do ALL the touch screen key matrix respond in the Key Test?
Yes
None
No
The CONTROL BD is faulty.
The touch screen ASSY is faulty.
The KEY BD is faulty.
The CONTROL BD is faulty.


The recorder does not print when the Start switch is pressed.
Can the recorder print when the magazine is pressed?
Yes
Adjust the position of the thermal head.
No
Check the following cable connections:
● CNA110 (CONTROL BD to CHARGE PUMP BD)
● CNA112 (CONTROL BD to MOTOR-SENS BD)
● CNA109 (POWER BD to CHARGE PUMP BD)
Normal
Check the DIP switches settings of the CONTROL BD.
Normal
● The CONTROL BD is faulty.
● The power unit is faulty.
The paper detection mark cannot be detected.
In the System Settings, is the paper detection mark set to on?
Yes
The paper detection mark sensor is dirty.
Check the following cable connections:
● CNA110 (CONTROL BD to CHARGE PUMP BD)
● CNA111 (MOTOR-SENS BD to PAPER SENS BD)
Normal
● The CONTROL BD is faulty.
● The PAPER SENS BD is faulty.
Only certain electrode lead waveforms are displayed on the screen or noise appears on the waveform.
(The electrode failure indication LED is blinking.)
Does this problem go away when a pattern generator is used?
Yes
The electrodes are defective.
● The electrode is not properly attached to the lead cable.
● The electrode is not properly attached to the patient skin or there is a high skin-to-electrode impedance.
No
● Was the result of the input box test normal when an input box checker is used?
● Does this problem go away when another good electrode leads cartridge is used?
Yes
● The electrode leads are faulty.
● The electrode leads cartridge is faulty.
No
The input box is faulty.


All the electrode leads waveforms are not displayed on the screen or noise appears on all the waveforms.
Does the "Connect input box" message appear on the screen?
No
Does this problem go away when a pattern generator is used?
Yes
The electrode, especially the N (RF) electrode, is defective.
● The electrode is not properly attached to the lead cable.
● The electrode is not properly attached to the patient skin or there is a high skin-to-electrode impedance.
No
● Was the result of the input box test normal when an input box checker is used?
● Does this problem go away when another good electrode leads cartridge is used?
Yes
● The electrode lead cable for the N (RF) electrode is faulty.
● The electrode leads cartridge is faulty.
No
The input box is faulty.
Yes
Does this problem go away when another good input box-instrument cable is used?
Yes
The cable connecting the input box to the instrument is faulty.
No
Do the electrode failure indication LEDs on the input box blink?
Yes
The CONTROL BD is faulty.
No
Does this problem go away when another good input box is used?
Yes
The input box is faulty.
No
The CONTROL BD is faulty.

3-2 Troubleshooting Table

Use the troubleshooting table to locate, identify and solve a problem in the instrument. The problems categorized into general operation, recording and fuse. Each problem category has its own troubleshooting table for fast and easy troubleshooting.

How to troubleshoot using the troubleshooting table

1. Determine which troubleshooting table to use.
2. In the "Symptom" column find the trouble item that matches the problem.
3. Do the action recommended in the "Corrective Action" column.
4. If the problem is not solved, do the action for the next possible cause or criteria.
5. If none of the actions solve the problem, contact your nearest Nihon Kohden dealer.

3-2-1 Troubleshooting General Operation Problem

Symptom	Possible Cause of Problem	Corrective Action
AC power lamp is on but there is no display and backlight on the LCD screen.	1. The fuse in the LCD KEY BD is blown. 2. The LCD KEY BD is faulty. 3. The LCD ASSY is faulty. 4. The Inverter unit is faulty.	1. Replace the fuse in the LCD KEY BD. 2. Replace the LCD KEY BD. 3. Replace the LCD ASSY. 4. Replace the Inverter unit.
The instrument does not operate during AC power operation.	1. The AC main fuse is blown. 2. The CNA107, CNA103 or CNA102 cable is not properly connected. 3. The Start/stop switch is dirty or the KEY BD is faulty. 4. The POWER BD is faulty. 5. The transformer is faulty.	1. Replace the AC main fuse. 2. Make sure CNA107, CNA103 and CNA102 cables are properly connected. 3. If the Start/stop switch is clean, replace the KEY BD Unit. 4. Replace the POWER BD. 5. Replace the transformer.
The instrument does not operate during battery power operation.	1. The battery is not charged. 2. The battery fuse is blown. 3. The battery is faulty. 4. The CNA107, CNA103 or CNA102 cable is not properly connected. 5. The POWER BD is faulty.	1. Charge the battery. 2. Replace the battery fuse. 3. Replace the battery. 4. Make sure CNA107, CNA103 and CNA102 cables are properly connected. 5. Replace the POWER BD.

Symptom	Possible Cause of Problem	Corrective Action
No key or switch operation.	1. The KEY BD is faulty. 2. Touch screen ASSY is faulty. 3. The LCD KEY BD is faulty. 4. The CONTROL BD is faulty.	1. Replace the KEY BD Unit. 2. Replace the touch screen ASSY. 3. Replace the LCD KEY BD. 4. Replace the CONTROL BD.
Only certain electrode lead waveforms are displayed on the screen or noise appears on the waveform.	1. The cables connection from the patient to the instrument is not properly connected, including the electrodes attachment to the patient. 2. The input box is faulty.	1. Make sure all cables connection from the patient to the instrument are properly connected, including the electrodes attachment to the patient. 2. Replace the input box.
All the electrode leads waveforms are not displayed on the screen or noise appears on all the waveforms.	1. The electrodes are not properly attached to the patient. 2. The input box is not properly connected to the instrument. 3. The input box is faulty. 4. The CONTROL BD is faulty.	1. Make sure the electrodes are properly attached to the patient. 2. Make sure the input box is properly connected to the instrument. 3. Replace the input box. 4. Replace the CONTROL BD.
The LCD panel cannot be made to stay at any position.	1. The hinge ASSY is loose. 2. The hinge ASSY is faulty.	1. Tighten the screws that attach the hinge ASSY to the bottom casing. 2. Replace the hinge ASSY.
Vertical strips appear at constant intervals along the X-axis.	1. The CNA101 cable is not properly connected. 2. The CONTROL BD is faulty. 3. The LCD ASSY is faulty.	1. Make sure the CNA101 cable is properly connected. 2. Replace the CONTROL BD. 3. Replace the LCD ASSY.

3-2-2 Troubleshooting Recording Problem

Symptom	Possible Cause of Problem	Corrective Action
The recorder does not feed the recording paper when the Start switch is pressed.	1. The paper detection mark sensor is dirty. 2. The CNA109, CNA110, CNA111, CNA112 or CNA102 cable is not properly connected. 3. The LCD KEY BD is faulty. 4. The KEY BD Unit is faulty. 5. The CONTROL BD is faulty. 6. The PAPER SENS BD is faulty. 7. The motor ASSY is faulty.	1. Clean the paper detection mark sensor. 2. Make sure that the CNA109, CNA110, CNA111, CNA112 and CNA102 cable is properly connected. 3. Replace the LCD KEY BD. 4. Replace the KEY BD Unit. 5. Replace the CONTROL BD. 6. Replace the PAPER SENS BD. 7. Replace the motor ASSY.
Recording paper is fed but there is no printing.	1. The thermal head is incorrectly positioned. 2. The CNA109, CNA110 or CNA112 cable is not properly connected. 3. The thermal head is faulty. 4. The power unit is faulty. 5. The CONTROL BD is faulty.	1. Readjust the position of the thermal head. 2. Make sure the CNA109, CNA110 and CNA112 cable is properly connected. 3. Replace the thermal head. 4. Replace the power unit. 5. Replace the CONTROL BD.
The paper detection mark cannot be detected.	1. The paper detection mark sensor is dirty. 2. The CNA110 or CNA111 cable is not properly connected. 3. The CONTROL BD is faulty. 4. The PAPER SENS BD is faulty.	1. Clean the paper detection sensor. 2. Make sure the CNA110 and CNA111 cables are properly connected. 3. Replace the CONTROL BD. 4. Replace the PAPER SENS BD.
Sometimes the recorder does print and blank recording paper is fed out from the recorder.	The thermal head has an input protection circuit that protects the thermal head from a high input voltage.	Check the electrode attachment to the patient, and if necessary, re-position the electrodes so that a good ECG waveform is displayed.

Symptom	Possible Cause of Problem	Corrective Action
The recording paper skews during recording.	1. The thermal head is dirty. 2. The paper is not properly placed in the instrument. 3. The recording paper from the external recording paper tray is not properly fed to the recorder. 4. The platen roller ASSY is faulty.	1. Clean the thermal head. 2. Make sure the paper is aligned with the rear edge of the recorder base cover. 3. Make sure recording paper from the external recording paper tray is properly fed to the recorder. 4. Replace the platen roller ASSY.

3-2-3 Troubleshooting Fuse Problem

Symptom	Possible Cause of Problem	Corrective Action
The AC main fuse is blown. (When the main power switch is switched on, the AC power lamp does not light up.)	1. The primary transformer circuit is faulty if a newly replaced fuse blows immediately after the instrument is turned on. 2. The secondary transformer circuit is faulty if a newly replaced fuse blows a while after the instrument is turned on.	1. Replace the: ● transformer ● POWER BD 2. Check all the printed circuit boards, and, if necessary, replace the faulty printed circuit boards.
The battery fuse is blown.	The following parts could be faulty: ● POWER BD ● CONTROL BD ● LCD KEY BD ● MOTOR ASSY ● Inverter unit	Replace the: ● POWER BD ● CONTROL BD ● LCD KEY BD ● MOTOR ASSY ● Inverter unit
The fuse in the LCD KEY BD is blown.	The following parts could be faulty: ● LCD KEY BD ● LCD module ● Inverter unit	Replace the: ● LCD KEY BD ● LCD module ● Inverter unit
The fuse in the POWER BD is blown.	The following parts could be faulty: ● POWER BD ● Battery	Replace the: ● POWER BD ● Battery

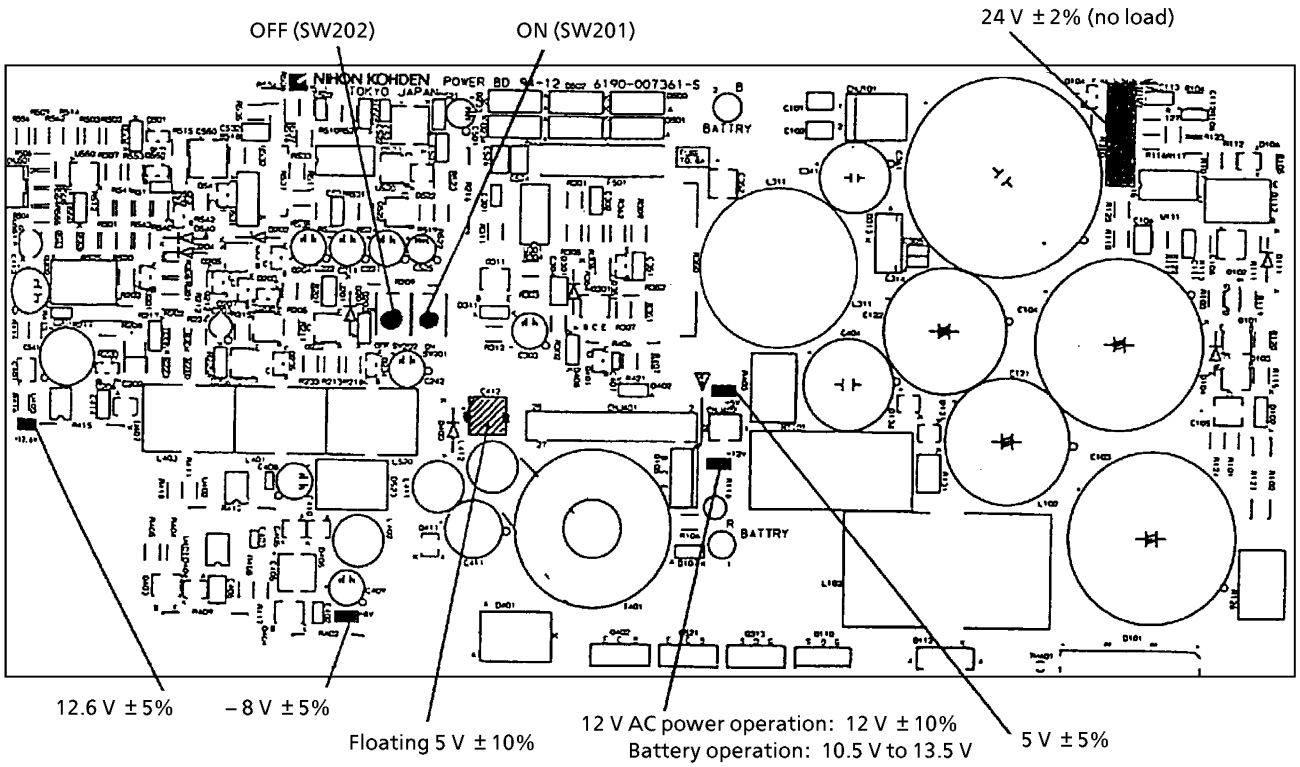
3-3 Troubleshooting the POWER BD

Use the procedure described below to troubleshoot the POWER BD. If the measured power supply is different from that described below, replace the POWER BD.

Procedure

1. Fully detach the top casing from the bottom casing as described in the "Disassembly and Assembly" section.
2. Reconnect the power supply to the instrument and switch on the main power switch in the rear panel of the instrument.
3. Reconnect the equipotential ground terminal with the ground lead.
4. Press the ON switch (SW201) on the POWER BD to switch the power on or press the OFF switch (SW202) on the POWER BD to switch the power off.
5. Connect the negative terminal of a digital voltmeter to the any screw attaching the POWER BD to the bottom casing.
6. Connect the positive terminal of the digital voltmeter to the test points listed in the table below.

Test Points	Power Supply	Description
12.6 V	12.6 V ±5%	Used in writing data onto the flash ROM.
−8 V	−8 V ±5%	Used in analog circuit.
12 V	AC power operation: 12 V ±10% Battery operation: 10.5 V to 13.5 V	Used in the sound generation circuit, motor, backlight and input box.
5 V	5 V ±5%	Used in digital circuits.
C412 (the two terminals of this capacitor) **NOTE** **Do not disconnect the CNJ 401 connector when measuring this capacitor because the board requires a load to output the power supply.**	Floating 5 V ±10%	Used in floating circuit and the EXTENSION I/O BD.
CNJ 301 (pin-1 to pin-8 has 24 V power supply and pin-9 to pin-16 has 0 V power supply) **NOTE** **Remove the connector from CNJ 301 and use any pin from pin-1 to pin-8 for measurement.)**	24 V ±2% (no load)	Used in the thermal head.



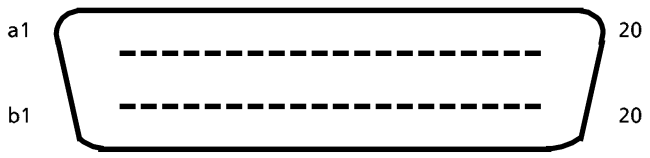
3-4 Troubleshooting the Electrode Leads Cartridge

Use the procedure described below to troubleshoot the electrode leads cartridge.

Procedure

1. Set a multimeter to RESISTANCE RANGE mode.
2. Connect one terminal of the multimeter to the electrode lead R/RA of the electrode leads cartridge and the other terminal to the pin number a2 of connector that connect the electrode leads cartridge to the input box.
3. Check that the reading of the multimeter electrode lead R/RA and pin number a2 is within the resistance limit of 22 kΩ ±10%.
4. Repeat steps 2 through 3 for all the electrode leads and pin numbers according to the resistance limits listed below.

Electrode Lead	Pin No.	Resistance Limit
R/RA	a2	22 kΩ ±10%
L/LA	a4	22 kΩ ±10%
F/LL	b9	22 kΩ ±10%
RF(N)/RL	b5	22 kΩ ±10%
C1/V1	a6	22 kΩ ±10%
C2/V2	a8	22 kΩ ±10%
C3/V3	a10	22 kΩ ±10%
C4/V4	a12	22 kΩ ±10%
C5/V5	a14	22 kΩ ±10%
C6/V6	a16	22 kΩ ±10%



3-5 System Error Message

The instrument continuously checks itself during operation for hardware or software failure. If a failure is detected, a "SYSTEM CALL ERROR DETAIL" or "Exception Message" message is displayed and all operations are stopped. In this message screen, pressing the START/STOP switch prints out the message. Press the START/STOP switch to re-start the instrument.

NOTE

If this message appears again, do not use the instrument until after service personnel have corrected the cause of the problem. Sending a copy of this system information message to your nearest NK distributor helps us to troubleshoot your problem quickly.

Message Examples

```
************** SYSTEM CALL ERROR DETAIL ***************

Error : Task is already created

System call     : Create Task
  Called        : 00068008
  Parameter     : 001B854C
    task ID             : $0809  2057
    priority            : $1388  5000
    entry address       :  000D6528
    stack size          : $00001388  5000
```

```
************** Exception Message ********************

Exception Cause : System Call Error 12

SSP    : 00178FBC    DO : 00130000     A0 :  001B854C
USP    : 001B8542    D1 : 0000003C     A1 :  001DF906
SR     :     0004    D2 : 04200000     A2 :  001DF904
PC     : 00068008    D3 : 0420FFFF     A3 :  001372A2
VECTOR:     0080    D4 : FFFFFFFF     A4 :  00134194
                    D5 : FFFF0000     A5 :  0013673C
                    D6 : 04200000     A6 :  001B8582
                    D7 : 00000000
USP  = 001B8542
       0000 E1A2  001B 854A  0000 0809  1288 000D
       6528 0000  1388 0000  0000 000D  64C8 0809
       1388 000D  6528 0000  1388 0027  000A C330
       000A C334  000A 9C9A  001B 8582  0000 0000
       000E 0001  000D D588  0420 0000  0000 BFF3
       001D F904  0013 FBDD  FFFF DIFF  FFFF 6534
       001B 8582  0420 0000  001D F90E  FFFF 0000
       0000 003C  0420 0000  0420 FFFF  FFFF FFFF
       FFFF 0000  0420 000E  0000 0007  001B 84EC
       001D F906  000A C350  000A C366  000A C2BA
       0021 89B0  000A C338  FFFF F7EC  FFFF FBBC
       2A41 5254  0420 0000  0420 FFFF  FFFF FFFF
       FFFF 0000  0020 0000  0020 FFFF  FFFF FFFF
       FFFF 0000  0420 0000  0420 FFFF  FFFF FFFF
       FFFF 0000  0020 0000  0420 FFFF  FFFF FFFF
       FFFF 0000  0420 0000  0420 FFFF  FFFF FFFF
       FFFF 0000  0420 0000  0420 FFFF  FFFF FFFF
       FFFF 0000  0420 0000  0420 FFFF  FFFF FFFF
       FFFF 0000  0020 0000  0420 FFFF  FFFF FFFF


 QP901D SYSTEM INFORMATION

DATE : 25 JAN 1995.  14:03
LINK : 24 JAN 1995.  19:11
VER  : 0.04
REV  : 024
```

3-6 Input Box Error

The instrument checks the input box, and if an error causing fault is detected, the "Input Box Malfunction" message is displayed and the leads off indication lamps on the input box blinks. In this case, the Input Box BD is faulty.

Description of the Error Type for the Error-blinking of the Indication Lamps

Fault Location	Error Type		Description (depending on C1, C2, C3, C4, and C6 LEDs)
	L	F	
ROM	Off	Blinks	C6 LED blinks: ROM check sum occurred; devices U201 is faulty
RAM	Blinks	Off	C6 LED blinks: Program memory Low byte error; device U204 is faulty C5 LED blinks: Program memory Mid byte error; device U203 is faulty C4 LED blinks: Program memory High byte error; device U202 is faulty C3 LED blinks: Data memory Low byte error; device U204 is faulty C2 LED blinks: Data memory Mid byte error; device U203 is faulty C1 LED blinks: Data memory High byte error; device U202 is faulty
I/O	Blinks	Blinks	C6 LED blinks: Communication error between AD and DSP ; Input BD or DPU BD is faulty

Section 4 SYSTEM TEST

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4-1 General

NOTE

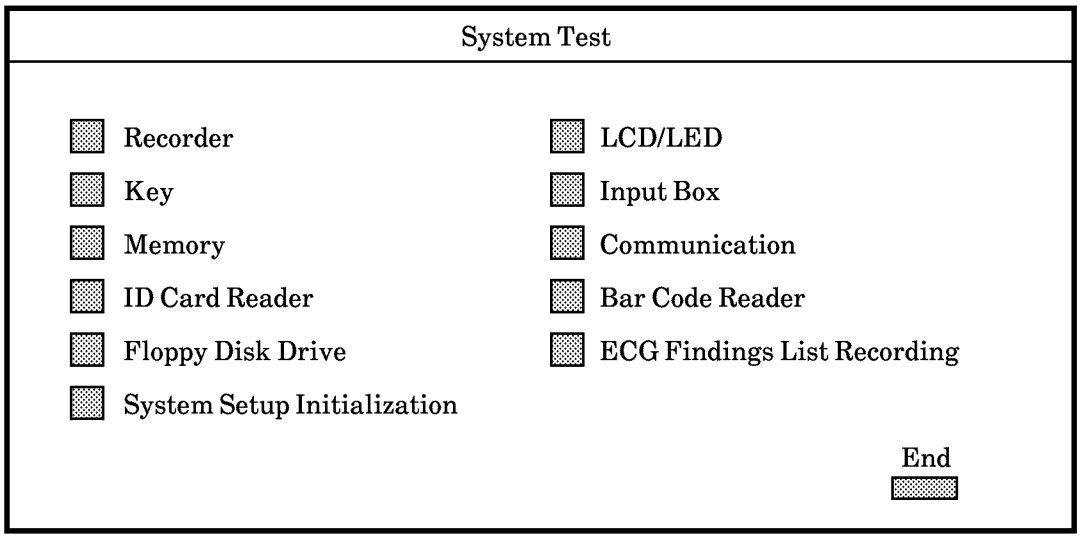
In the description of each test item in this section, whenever it is appropriate, a description of the source of problem and its corrective action will be described in table form for fast and easy troubleshooting. If there is more than one corrective action, they are listed from the highest to lowest priority.

The System Test menu window consists of the following test items:

- Recorder
- Key
- Memory
- ID Card Reader
- Floppy Disk Drive
- System Setup Initialization
- LCD/LED
- Input Box
- Communication
- Bar Code Reader
- ECG Findings List Recording

Procedure

1. In the System menu screen, press the System Test key to call up the System Test window.



2. Press the item key to start the test.

3. Press the End key to quit the System Test window.

4-2 Recorder

This is used to check the condition of the thermal head by printing out recording test patterns that contain graphics and characters. If the printing is uneven or some information in the recording test patterns is lost, then the thermal head may be dirty, worn out or out of position.

Procedure

1. Make sure the magazine is in place and recording paper is loaded.

2. In the System Test menu window, press the Recorder key to start the test. The recorder continuously prints out the recording test patterns.

3. Press the Recorder key again to stop the printing.

4. Press the Cancel key to quit the test.

The recording test patterns consist of the following patterns:

1. Diagonal lines
2. The character X
3. Baselines
4. Paper speed scales
5. Rectangular dotted-waveform for paper detection mark
6. Bar code

4-2-1 Check Procedure for Diagonal Lines

Check that all the diagonal lines are evenly and completely printed.

Possible Source of Problem	Corrective Action
A dirty thermal head can cause some parts to be unevenly or incompletely printed.	1. Clean the thermal head. 2. If this does not fix the problem, replace the thermal head.
A faulty thermal head can cause some parts at a certain position to be unevenly or incompletely printed.	1. Clean the thermal head. 2. If this does not fix the problem, replace the thermal head.

4-2-2 Check Procedure for the Character X

Check that all the parts of the grid are clearly, evenly and completely printed.

Possible Source of Problem	Corrective Action
A badly positioned thermal head can cause uneven and incomplete printing.	1. Adjust the thermal head position. 2. If this does not fix the problem, replace the thermal head.
An incorrectly set thermal head recording resolution setting can cause faint or unclear printing.	1. Check that SW1 of the SW1701 of the CONTROL BD is set to OFF. If not, set it to OFF. 2. If this does not fix the problem, replace the thermal head.

4-2-3 Check Procedure for Baselines

NOTE

The suggested corrective actions for the grid procedure may also fix problems for the baselines check procedure.

Check that all 12 baselines are clearly, evenly and completely printed. The thickness of each baseline must be less than 1 mm.

Possible Source of Problem	Corrective Action
A faulty CONTROL BD can cause unclear, uneven and incomplete printing.	Replace the CONTROL BD.

4-2-4 Check Procedure for Paper Speed Scales

Check that the accuracy of each paper speed during actual recording is within 2%. For example, the length for 4 seconds on the time scale printed at 25 mm/s paper speed must be within 98 mm to 102 mm.

Possible Source of Problem	Corrective Action
A loose platen roller ASSY can cause inaccurate paper speed.	Tighten the loose platen roller ASSY as described in the “Disassembly and Assembly” section.
A damaged gear on the platen axle ASSY or a deformed platen axle ASSY can cause the inaccurate paper speed.	Replace the platen axle ASSY.
A dirty motor rotation sensor can cause inaccurate paper speed.	Clean the motor rotation sensor as described in "Maintenance" section.
A dirty or faulty motor ASSY, motor gear ASSY, worm ASSY or worm foil ASSY.	1. Check and clean the motor ASSY, worm ASSY, worm foil ASSY or motor gear ASSY. 2. If this does not fix the problem, replace the motor ASSY or motor gear ASSY.

4-2-5 Check Procedure for Rectangular Dotted-waveform for Paper Detection Mark

Check that a rectangular dotted-waveform is printed at the bottom of the recording paper before the paper detection mark.

Possible Source of Problem	Corrective Action
A faulty paper detection mark sensor can cause the recorder to not print the dotted line.	Replace the PAPER SENSORS ASSY.
A faulty CONTROL BD can cause the recorder to not print the dotted line.	Replace the CONTROL BD.

4-2-6 Check Procedure for Bar Code

Use a bar code reader to read the bar code printed in the recording test pattern. The bar code reader should read:

0123456789

4-3 Key

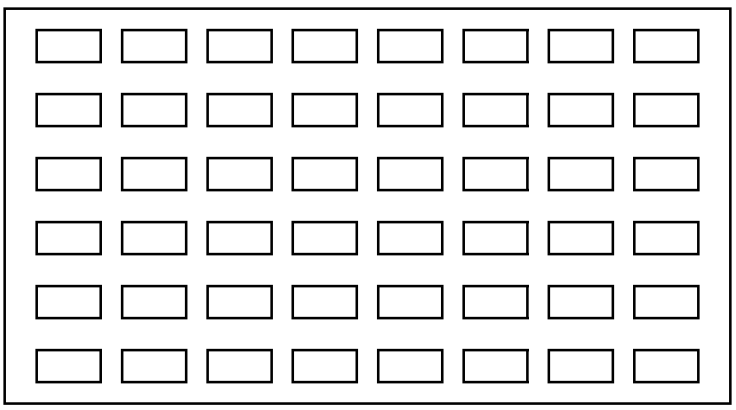
This is used to check the condition of the keys on the operation panel and the touch key screen.

Procedure for Operation Panel Key

1. In the System Test menu window, press the Key key to start the test.
2. Press the operation panel key. The name of the pressed key appears on the Key test screen if the key is functioning correctly.
3. Press the Cancel key to quit the test.

Procedure for Touch Screen Key

1. Touch the touch screen key matrix. The touched key matrix is highlighted if the touch screen key matrix is functioning correctly.



2. Press the Cancel key to quit the test.

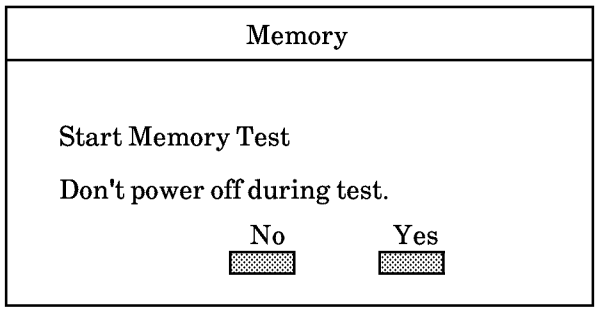
Possible Source of Problem	Corrective Action
A faulty touch panel ASSY can cause keys, anywhere on the screen, to not light up when touched.	Replace the touch panel ASSY.
A faulty connection in the CNJ-013 and CNJ-014 flat-cable, a faulty touch panel ASSY or faulty LCD KEY BD can cause the keys along a row or column on the screen to not light up when touched.	1. Make sure the CNJ-013 and CNJ-014 cables are properly connected. 2. Replace the touch panel ASSY. 3. Replace the LCD KEY BD.

4-4 Memory

This is used to continuously check the condition of the memory circuits by comparing the data of the test patterns written to and read from the memory circuits. An asterisk mark and "in test" message by the side of the test item shows that the test is in progress. At the end of each test, the system displays the "Normal" or "Malfunction" message, depending on the result of the test. After completing the test on one test item, the test progresses to the next test item. When all the test items are tested, the system repeats the whole test again until the Cancel key is pressed. Every time the system repeats the whole test, the count increases by one.

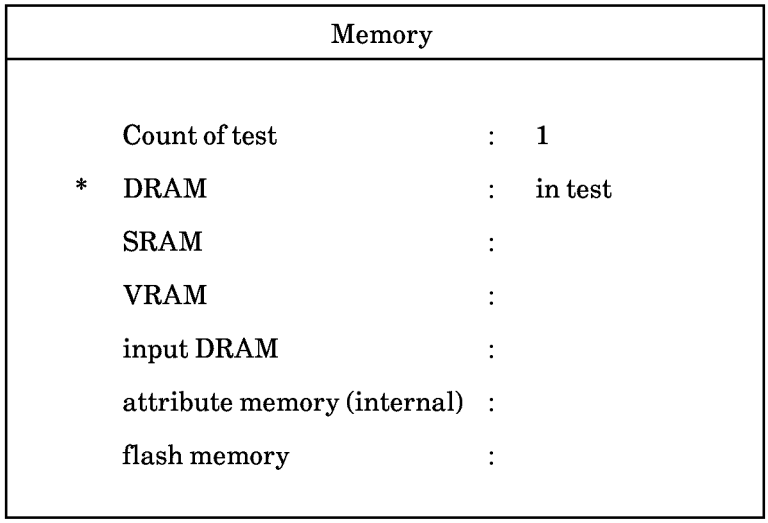
Procedure

1. In the System Test menu window, press the Memory key to call up the following window.



2. Press the Yes key to start the test or press the No key to stop the test. Pressing the Yes key calls up the following Memory test screen.

<Example of screen display during the test>



3. Press the Cancel key to quit the test.

Possible Source of Problem	Corrective Action
A faulty CONTROL BD can cause the malfunction message to appear in this test.	Replace the CONTROL BD.

4-5 ID Card Reader

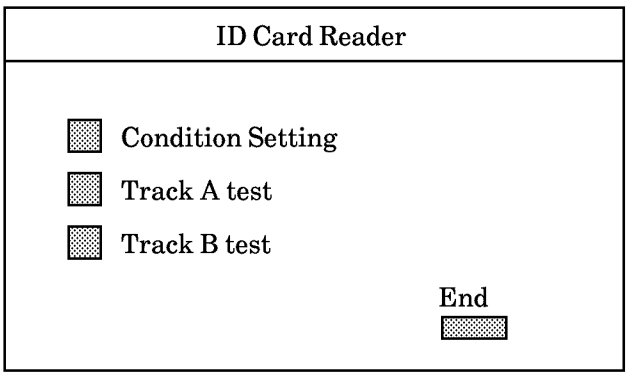
There are three items in this test. The first item, Condition Setting, is not a test, but a tool that sets the format of track A and B of the ID card (magnetic card). The second and third items are the actual test items that are used to check the condition of track A and B of the ID card by reading the data written in the ID card. At the end of each test, the system displays the "Normal" or "Malfunction" message, depending on the result of the test.

NOTE

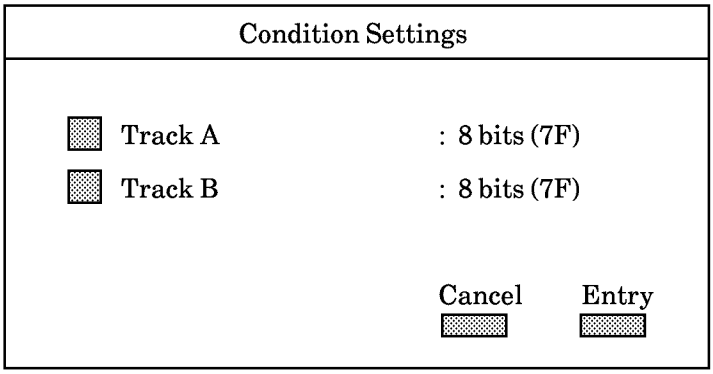
There are two types of ID card (magnetic card) readers, QI-911E and QI-912E. Make sure the ID Card Settings is set to the type of the installed ID card reader before performing this test.

Procedure for the Condition Setting

1. In the System Test menu window, press the ID Card Reader key to call up the following window.



2. In the ID Card Reader test window, press the Condition Setting key to call up the following window.
   <Example of window display during the test>



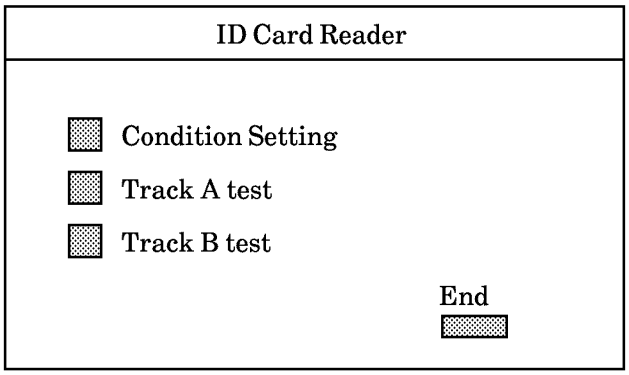
3. Press the Track A or Track B key to call up the condition settings.

4. Press the desired setting. The selected setting of the selected track is displayed in the Condition Setting window.

5. Press the Cancel key to quit the Condition Settings window without changing any settings.
   Press the Entry key to register the setting changes.

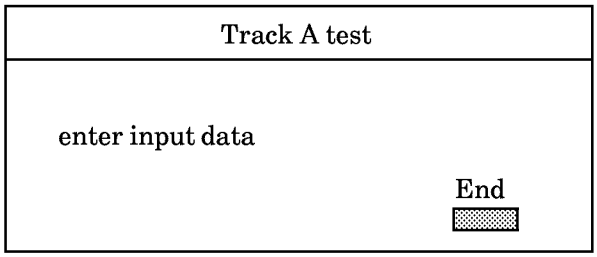
Procedure for the Test

1. In the System Test menu window, press the ID Card Reader key to call up the following window.



2. Press the Track A test or Track B test key to start the test.

   <Example of window display during the test>



3. Slide an ID card that has data written in it along the slide guide. The information in the ID card will be displayed in its ASCII coded form.

4. Press the End key to quit the test.

Possible Source of Problem	Corrective Action
The faulty ID card can cause different data to be displayed on the screen.	Replace the ID card.
If replacing the ID card does not fix this problem, the ID card reader unit is faulty.	Replace the ID card reader unit.
A poor CNA106 cable connection.	Make sure the CNA106 cable is properly connected.
A faulty CONTROL BD.	Replace the CONTROL BD.

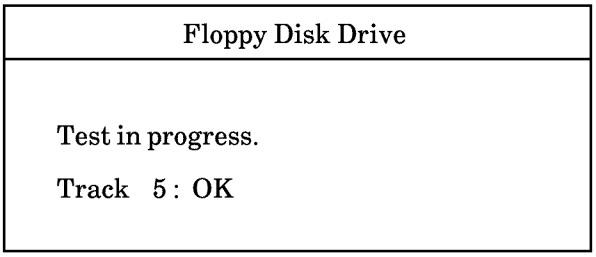
4-6 Floppy Disk Drive

This is used to check the condition of the optional floppy disk drive unit by reading the data written in the floppy disk. At the end of each test, the system displays the "Normal" or "Malfunction" message, depending on the result of the test.

Procedure

In the System Test menu window, press the Floppy Disk Drive key to call up the following window.

<Example of window display during the test>



At the end of the test, the system returns to the System Test menu window.

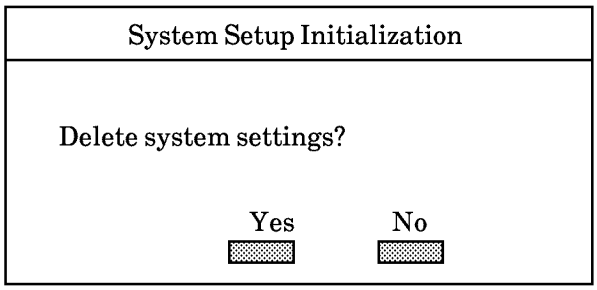
Possible Source of Problem	Corrective Action
A bad sector in a floppy disk shows that the floppy disk is damaged.	Replace the floppy disk with a newly formatted disk.
A bad sector in a newly formatted floppy disk shows that the floppy disk drive unit is faulty.	Replace the floppy disk drive unit.

4-7 System Setup Initialization

This is not a check, but a function to initialize the instrument to its default settings.

Procedure

1. In the System Test menu window, press the System Setup Initialization key to call up the following window.



2. Press the Yes key to start the initialization.

3. Press the No key to quit this function.

4-8 LCD/LED

This is used to check the LCD and LEDs in the operation panel. The LCD displays test patterns on the screen during the test. The LEDs in the operation panel blinks during the test.

Procedure

1. In the System Test menu window, press the LCD/LED key to call up the check window.

2. Check whether all the dots on the screen light up and go out according to the test pattern.

Possible Source of Problem	Corrective Action
A faulty LCD ASSY can cause white dots to appear on the black part of the screen or black dots to appear on the white part of the screen during the test.	Replace the LCD ASSY.
A faulty CNA101 and CNA103 cables connection, CONTROL BD or LCD ASSY can cause vertical stripes to appear on the screen during the test or normal operation.	1. Make sure the CNA101 and CNA103 cables are properly connected. 2. Replace the CONTROL BD. 3. Replace the LCD ASSY.

3. Check whether all the LEDs in the operation panel blinks.

Possible Source of Problem	Corrective Action
A faulty KEY BD can cause a few LEDs to not blink during the test.	Replace the KEY BD.
A faulty KEY BD or LCD KEY BD can cause all the LEDs to not blink during the test.	Replace the KEY BD or the LCD KEY BD.

4. At the end of the test, the screen returns to the System Test menu window.

4-9 Input Box

NOTE

- **An input box checker is needed to fully perform the check described below. The input box checker is actually an electrode leads cartridge without the electrode leads cables. In replacement, it has a single cable with a connector at the end.**
- **The test result of the input box test can help Nihon Kohden engineers to troubleshoot and determine the cause of the faulty input box. Please provide a copy of the test result when sending your input box for repair.**

This is used to check the condition of the instrument and the connected input box. This test has two parts. The first part of the test checks the digital communication line between the instrument and the input box. The second part of the test checks the input box and analog line. To perform the first part of the test, connect the input box to the instrument via the instrument's input box socket A or B.

To perform the second part of the test, in addition to the connection for the first part of the test, use the input box checker to loop its cables back to the instrument via the external input/output socket of the instrument. Without this test-loop connection the "malfunction" result message is displayed for the second part of the test.

The input box test consists of the following test items:

1. Input Box
   - 1-1 Self Test Result
   - 1-2 Program Download
   - 1-3 Sampling Rate
2. Input Data Test
   - 2-1 Noise Level
   - 2-2 Sensitivity
   - 2-3 Frequency Response

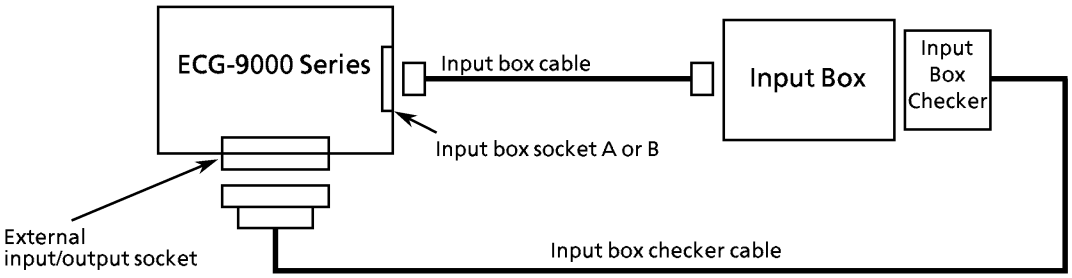
Preparation

1. In the System Setup window menu, set the AC filters settings to the local AC frequency.

2. Connect the input box to the instrument.

3. Use the input box checker to connect its cable to the external input/output connector at the rear of the instrument.

Test-loop Connection



Procedure

1. In the System Test menu window, press the Input Box key to start the test. At the end of the test, the test result is displayed on the screen.

<Example of screen display during the test>

```
Patient       : A
Input Box     : Connect
       Type    : JC-901D
       Version : 0.7
      Self test result:normal          Result    :normal
      Program download:normal
      Sampling rate   :normal          Error  :0.0%

Input data test   :Not Connect or connector malfunction
            Noise level : malfunction
                                I= *   uV     V1= *   uV
                               II= *   uV     V2= *   uV
                               M1= *   uV     V3= *   uV
                               M2= *   uV     V4= *   uV
                               M3= *   uV     V5= *   uV
                               M4= *   uV     V6= *   uV
                             EXT1= *   mV
                             EXT2= *   mV
            Sensitivity:malfunction
                   Error(absolute)
                                I= *   %      V1= *   %
                               II= *   %      V2= *   %
                               M1= *   %      V3= *   %
                               M2= *   %      V4= *   %
                               M3= *   %      V5= *   %
                               M4= *   %      V6= *   %
                   Error(relative)
                                I= *   %      V1= *   %
                               II= *   %      V2= *   %
                               M1= *   %      V3= *   %
                               M2= *   %      V4= *   %
                               M3= *   %      V5= *   %
                               M4= *   %      V6= *   %
                             EXT1= *   %
                             EXT2= *   mV
          Frequency response:malfunction
                                I= *   %      V1= *   %
                               II= *   %      V2= *   %
                               M1= *   %      V3= *   %
                               M2= *   %      V4= *   %
                               M3= *   %      V5= *   %
                               M4= *   %      V6= *   %
                             EXT1= *   %
```

2. Press the Start switch to record the result of the test.

4-9-1 Check Procedure for Input Box

Check the digital communication line between the instrument and the input box. The result message for this test item is "Connect" or "Not connect".

Possible Source of Problem	Corrective Action
The cable connection between input box and the instrument is faulty.	Make sure the cable between the input box and the instrument is properly connected.
The input box is faulty.	Replace the input box.
The CONTROL BD is faulty.	Replace the CONTROL BD.

4-9-1-1 Check Procedure for Self Test Result

Check the memory and A/D conversion circuits in the input box. The result message for this test item is "normal" or "malfunction".

Possible Source of Problem	Corrective Action
The memory and A/D conversion circuits in the input box are faulty.	Replace the input box.

4-9-1-2 Check Procedure for Program Download

Check the program downloading function of the input box. This program downloading function allows the instrument to download program software to the input box. The result message for this test item is "normal" or "malfunction".

Possible Source of Problem	Corrective Action
The cable connection between input box and the instrument is faulty.	Make sure the cable between the input box and the instrument is properly connected.
The input box is faulty.	Replace the input box.
The CONTROL BD is faulty.	Replace the CONTROL BD.

4-9-1-3 Check Procedure for Sampling Rate

Check the sampling rate and accuracy of the data transmission from the input box to the instrument. The result message for this test item is "normal" or "malfunction". A result is considered malfunction when the data accuracy is not within ±0.2%.

Possible Source of Problem	Corrective Action
The CONTROL BD or input box is faulty.	Replace the CONTROL BD or input box. You may want to use a different instrument or input box to determine the source of this problem.

4-9-2 Check Procedure for Input Data Test

The instrument outputs an analog check signal to the input box checker of the input box via the external output socket. The analog check signal passes through the input box and returns to the instrument via the input box socket A or B. The result message for this test item is "Connect" or "Not connect".

Possible Source of Problem	Corrective Action
The input box checker cable connection back to the instrument's external input/output socket is faulty.	Make sure the input box checker cable is properly connected.
The input box is faulty.	Replace the input box.
The CONTROL BD is faulty.	Replace the CONTROL BD.
The input box checker is faulty.	Replace the input box checker.

4-9-2-1 Check Procedure for Noise Level

NOTES

- **Set the AC Filter settings to 50 Hz or 60 Hz before performing this test to reduce the noise generated by an AC power source.**
- **Place the input box and input box checker and input box checker cable as far away as possible from an AC power sources before performing this test to reduce the noise generated by AC power sources.**

Check the noise level for the electrode leads input of the input box by measuring the noise level of the returned analog check signal. The noise level for electrode lead I to V6, M1 to M4 is considered normal when the level is below 40 μV. The noise level for electrode lead EXT 1 and EXT 2 is considered normal when the level is below 30 mV. The result message for this test item is "normal" or "malfunction".

Possible Source of Problem	Corrective Action
If a "Connect" message is displayed for the input data test and a "malfunction" is displayed for the noise level, then the input box is faulty.	Replace the input box.

4-9-2-2 Check Procedure for Sensitivity

Check the sensitivity of each of the electrode lead input processing circuits by comparing the returned and output analog check signals. The result of the comparison is displayed as absolute error or relative error for each of the electrode leads I to V6 and M1 to M4. Only the absolute error for the electrode lead EXT 1 is displayed. The "malfunction" message is displayed when the absolute error is less than 90% and more than 110% or when the relative error is less than 95% or more than 105% for any electrode lead. The result message for this test item is "normal" or "malfunction".

Possible Source of Problem	Corrective Action
If the absolute error for any of the electrode leads, I to V6 and M1 to M4, is less than 90% or more than 110%, the CONTROL BD or the input box is faulty.	Replace the CONTROL BD or input box. You may want to use a different instrument or input box to determine the source of this problem.
If the relative error for any of the electrode leads, I to V6 and M1 to M4, is less than 95% or more than 105%, the CONTROL BD or the input box is faulty.	Replace the CONTROL BD or input box. You may want to use a different instrument or input box to determine the source of this problem.
If the absolute error for the electrode lead EXT 1 is less than 90% or more than 110%, the CONTROL BD is faulty.	Replace the CONTROL BD.
If the EXT2 has a value more than 20 mV, there could be a faulty wiring in the input box or input box cable.	Replace the input box or input box cable.

4-9-2-3 Check Procedure for Frequency Response

Check the response frequency for electrode leads I to V6, M1 to M4 and EXT 1 by measuring the frequency response accuracy of the returned analog check signal from each electrode lead input processing circuit. The "malfunction" message is displayed when the accuracy of the response frequency of the electrode lead input processing circuit is less than 90% or more than 105% for any electrode lead. The result message for this test item is "normal" or "malfunction".

Possible Source of Problem	Corrective Action
The input box is faulty.	Replace the input box.

4-10 Communication

The test sends out 400 test patterns and then compares the received test patterns with their original patterns. A "faulty" is displayed if one of the received test patterns is different from its original. A "normal" message is displayed if the communication line is normal.

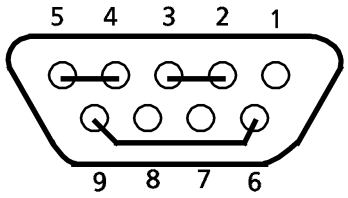
The screen can only display 10 out of the 400 test patterns.

This is used to check the external communication input/output line of the instrument. The instrument has one standard communication connector (SIO-1) and two optional communication connectors (SIO-2 and SIO-3). The two optional communication connectors (SIO-2 and SIO-3) are only available when the optional EXTENSION I/O BD is installed into the instrument.

A maximum of 10 error data can be displayed.

Preparation

A specially modified connector is required for the three test items in this test. To modify the connector, short the pins as shown in the illustration below.



Connector Pin Assignment

1 FG
2 TxD
3 RxD
4 RTS
5 CTS
6 DSR
7 SG
9 DTR

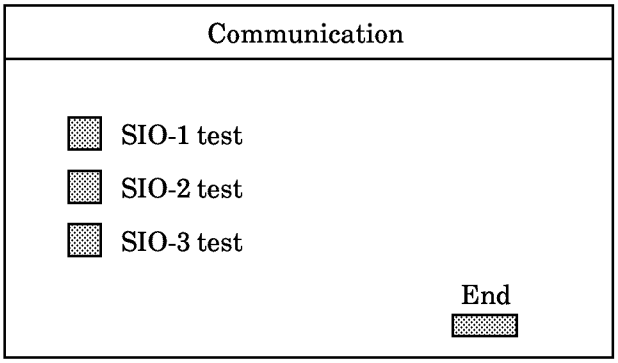
Mating connector type: DE-9P
NK Parts Code No.: 079362

Mating connector housing type: DE-C1-J6
NK Parts Code No.: 080788

Procedure

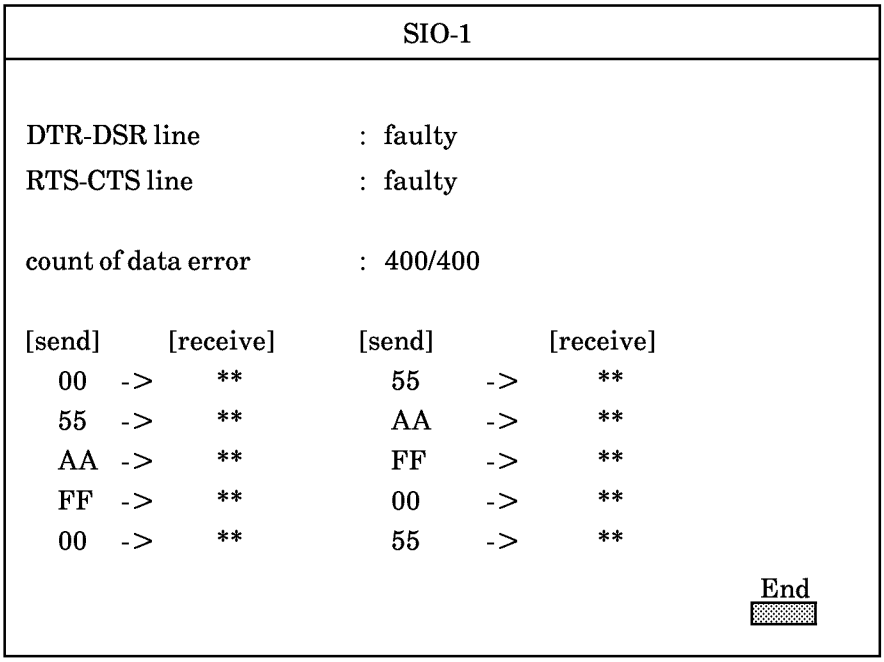
1. Insert the modified connector into the selected SIO connector.

2. In the System Test menu window, press the Communication key to call up the following window.



3. Press the communication line key to start the test for the selected SIO connector. The test begins and the following window is displayed.

<Example of window display during the test>


SIO-1
DTR-DSR line : faulty
RTS-CTS line : faulty
count of data error : 400/400
[send] [receive] [send] [receive]
00 -> ** 55 -> **
55 -> ** AA -> **
AA -> ** FF -> **
FF -> ** 00 -> **
00 -> ** 55 -> **
End

4. Press the End key to quit the test.

Possible Source of Problem	Corrective Action
A fault in the CONTROL BD can cause the malfunction message to appear in the SIO-1 test.	Replace the CONTROL BD.
A fault in the EXTENSION I/O BD can cause the malfunction message to appear in the SIO-2 or SIO-3 test.	Replace the EXTENSION I/O BD.

4-11 Bar Code Reader

Check the bar code reader unit by comparing the ASCII coded data of the bar code displayed on the screen and the actual value of the bar code.

Possible Source of Problem	Corrective Action
A poor cable connection or a faulty CONTROL BD can cause the bar code reader window not to read the bar code even when a beep sound is generated when reading the bar code.	1. Make sure the bar code reader is properly connected. 2. If this does not fix the problem, replace the CONTROL BD.
A not initialized bar code reader or a faulty bar code reader can cause the bar code reader window not to read the bar code data. No beep is generated in this case.	1. Initialize the bar code reader according to the procedure described in the Operator's Manual. 2. If this does not fix the problem, replace the bar code reader.

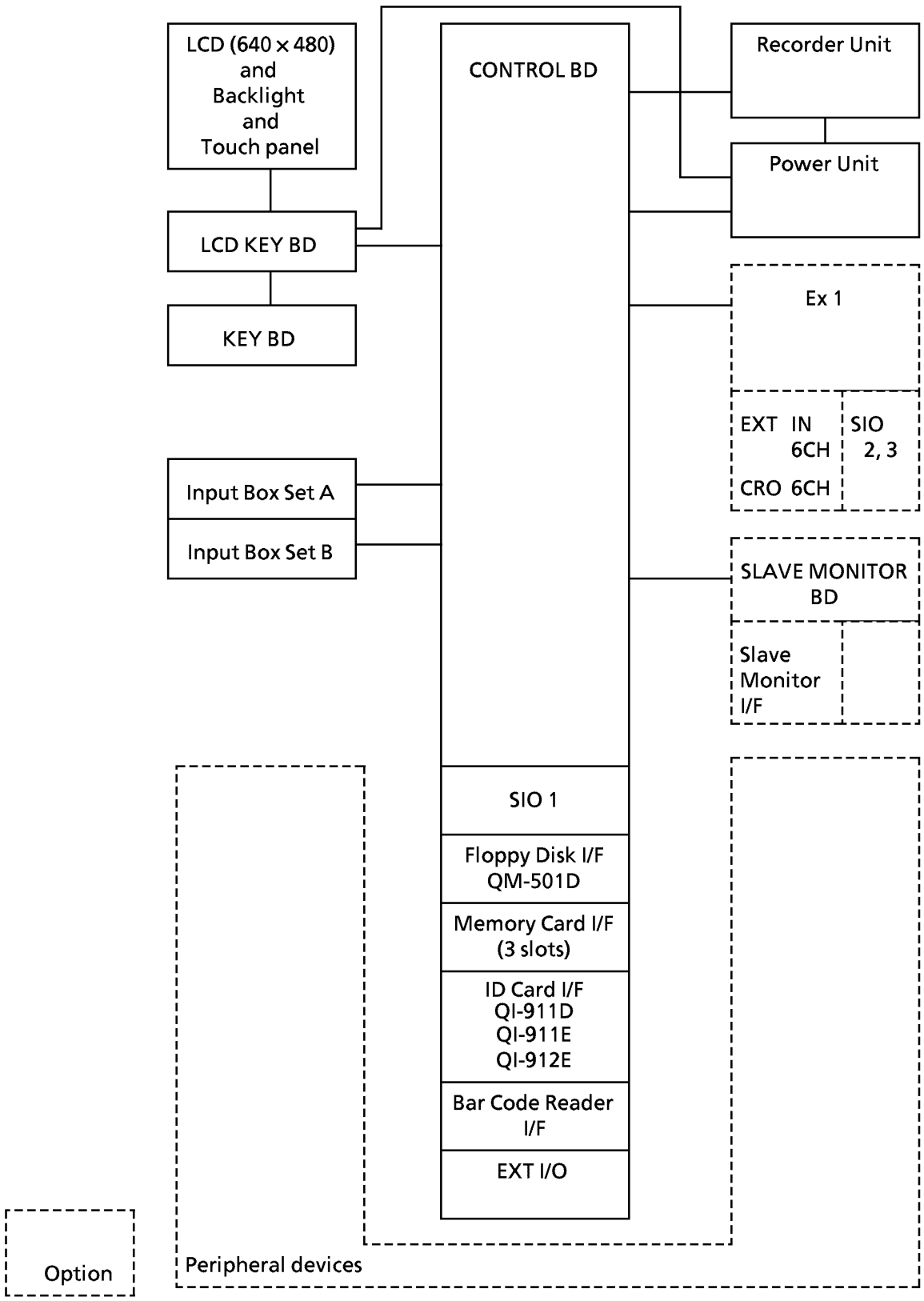
4-12 ECG Findings List Recording

This is not a check. Pressing the ECG Findings List Recording key in the System Test menu window prints the ECG findings list of the instrument with their codes. Pressing the ECG Findings List Recording key during printing stops the printing.

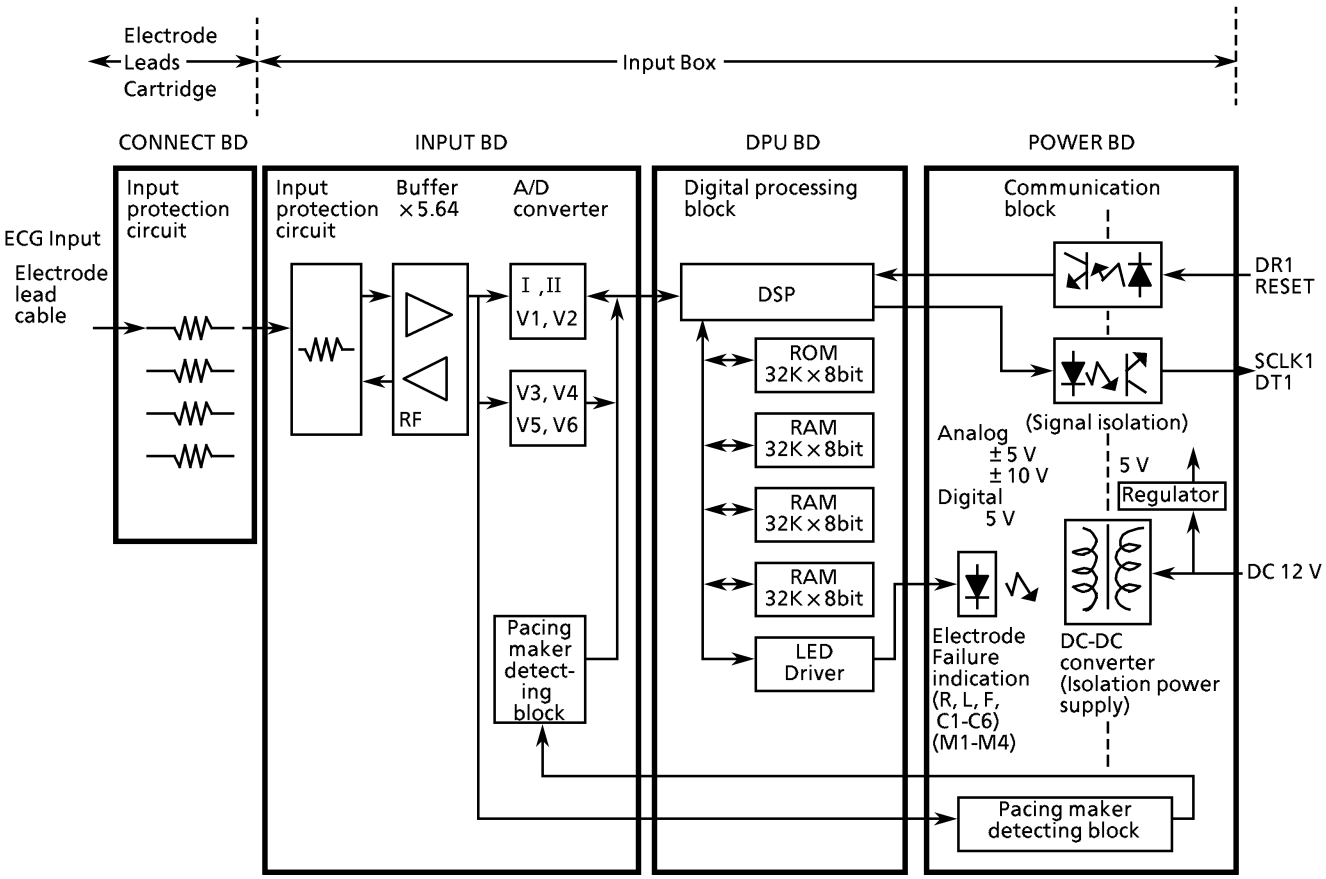
Section 5 BOARD DESCRIPTION

5-1 General 5.1
5-2 Input Box Set 5.2
5-3 CONTROL BD 5.4
5-4 LCD KEY BD 5.6
5-5 KEY BD 5.6
5-6 POWER Unit SC-901D 5.6
5-7 Recorder Unit 5.7
5-8 LCD Module 5.7
5-9 Extension I/O Board 5.7
5-10 Slave Monitor Interface 5.8

5-1 General


LCD (640 × 480)
and
Backlight
and
Touch panel
LCD KEY BD
KEY BD
CONTROL BD
Recorder Unit
Power Unit
Ex 1
EXT IN
6CH
CRO 6CH
SIO
2, 3
Input Box Set A
Input Box Set B
SLAVE MONITOR
BD
Slave
Monitor
I/F
SIO 1
Floppy Disk I/F
QM-501D
Memory Card I/F
(3 slots)
ID Card I/F
QI-911D
QI-911E
QI-912E
Bar Code Reader
I/F
EXT I/O
Option
Peripheral devices

5-2 Input Box Set



The input box set consists of the electrode leads cartridge and the input box. The electrode leads cartridge merges all the electrode leads cables into one connector and protects the input box from high input voltages. The input box receives the merged patient signals from the electrode leads cartridge, conditions them and then outputs the signals to the instrument.

The electrode leads cartridge has one printed circuit board: the CONNECT BD. The electrode leads cables are soldered to this board. The signal from each cable passes through the input protection circuit before merging into one connector.

The input box has three printed circuit boards, the INPUT BD, the DPU BD and the POWER BD. The functions of the input box are grouped into input block, processing and control block, communication block and power block.

Input Block

This block consists of the INPUT BD. The INPUT BD sums all the signals from the electrode leads cartridge into their various leads, such as lead I to II and V1 to V6. Then, it A/D converts all the leads signals. The A/D converter has a sampling rate of 2000 samples per second and a resolution of 0.2114 μV per LSB.

Processing and Control Block

This block consists of the DPU BD. The DPU BD consists of a 14.336 MHz Digital Signal Processor (DSP), a 32 K×8 bit boot ROM, a 12 K×16 bit data RAM, a 16 K×24 bit program RAM and an LED driver.

The functions of the DSP are as follows:

1) filters the A/D converted leads signals by using selected hum filtering and time constant filtering programs.
2) controls the bus lines through a 7.168 MHz timing signal.
3) controls the A/D converter in the INPUT BD through a 7.168 MHz timing signal.
4) controls the electrode failure indication LED driver.
5) transmits the filtered signals to the instrument via the POWER BD. (The DSP has a sampling rate of 1000 samples per second and a resolution of 1.25 μV per LSB for transmission.)

Communication Block

The DSP of the DPU BD uses a serial port to communicate with the instrument.

Power Block

This block consists of the POWER BD. This block has a floating and a non-floating circuit. Transformers and photo-couplers are used to separate the floating from the non-floating circuit. In the non-floating circuit, a three-terminal regulator is used to convert the 12 V into 5 V. The 5 V is used to drive devices located in the non-floating circuit. In the floating circuit, the transformed 12 V is regulated by a diode and capacitor output the 10 V and ±5 V. ±10 V is used to drive the analog devices and ±5 V is used to drive the digital devices in the non-floating circuit. An 8 kV gas arrestor is used to prevent excessive high voltage from flowing into the floating and non-floating circuits. The pacing pulse detection circuit in this block checks the lead II signal from the input block for pacing pulse.

5-3 CONTROL BD

The functions of the CONTROL BD are grouped into:

1) System Control Block
2) Data Storage Interface Block
3) ECG Input/Output Block
4) Recording Control Block
5) Motor Control Block
6) Paper Mark Detection Block
7) Graphics Block
8) Key and Interface Block

System Control Block

This block is based on the 68330 CPU. The flash ROM in this block that stores the system program also allows the upgrading of the system program or the addition of other utility programs from a program card.

Data Storage Interface Block

This block interfaces with various memory cards or floppy disks in the instrument. There are three slots for memory cards or program cards and one slot for a floppy disk drive. In addition to these, the instrument can also interface with the ID card reader, bar code reader or another electrocardiograph through the analog input or output connector, ID card reader connector, bar code reader connector or single channel RS-232C connector.

ECG Input/Output Block

This block is based on a slave 16 MHz 68000 CPU and supported by a 256 KB RAM. The system CPU downloads the programs to the RAM in this block and the CPU in this block runs the program to process the ECG signals output from the input box set. This block also controls the 2-channel external input and 1-channel CRO output of the analog ECG signals through a single chip gate array. The transmission resolution of this single chip gate array is 2.5 mV per 12-bit LSB.

Recording Control Block

This block controls the printing of the waveforms, alphanumeric characters, graphics, baselines and grid.

Waveforms:
The system CPU sets the internal register of the recorder LSI for the start and end printing points of each channel of ECG waveform. The recorder tags the ECG waveform data with its the start and end points and outputs the tagged ECG waveform data to the thermal head. The internal register of the recorder LSI codes the on and off bit of each dot of the thermal head.

Alphanumeric Characters:
A dual port buffer memory that allows the writing and reading operations to be performed simultaneously is used. As one line of alphanumeric characters data is

written to a page in the dual port buffer memory, data that was earlier written to the other page is read to the thermal head for printing.

Graphics:
Bitmapped graphic data from the memory of the display controller is written to a dual port memory through the control of the DMA controller of the recorder LSI. The bitmapped graphic data written to this dual port memory is read out to the thermal head for printing.

Baselines:
A switch is used to change the thickness of the baseline and waveform for printing through a selection of the dot size. The three available dot sizes are 2-dot, 3-dot or 4-dot.

Grid:
Grid data is written to the dual port memory during start up of the system. Therefore, during printing, waveforms, graphic and alphanumerics data are read together with the grid data to the thermal head.

Motor Control Block

This block uses speed feedback stabilization method and a power saving PWM drive to enhance the PLL control of the motor. The control range is from 5 mm per second to 50 mm per second.

Paper Mark Detection Block

This block uses a photo-sensor to detect the paper mark of the recording paper. A light is shined onto the recording paper and the reflected light is picked up by the photo-sensor. The output voltage of the photo-sensor varies with the presence or absence of the paper mark.

Graphics Block

This block is based on a graphic controller that draws graphics for display and printing. The graphic controller is supported by a 1 MB VRAM and a character generator. The system CPU through a gate array LSI provides the addresses for the graphics and characters to be written to the VRAM. Another gate array LSI is used to allow the LCD and slave monitor to access the data in this VRAM.

Key Interface Block

With the exception of the power switch and LEDs, the rest of the switches on the operation panel are controlled by the one chip 4-bit CPU on the LCD KEY BD.

5-4 LCD KEY BD

This board controls:

1) the key input and touch panel input of the instrument through a 4-bit single chip CPU (μPD75108).
2) the switching regulator to convert +12 V power supply to a −16 to −20 V variable power supplies for the LCD.

This board also supplies the +12 V power supply to the Inverter unit where the +12 V power supply is converted to 1.5 kV for the backlight.

5-5 KEY BD

The KEY BD functions as an input for key operation and the control of the LEDs of the operation panel.

5-6 POWER Unit SC-901D

This power unit consists of the AC inlet, AC switch, fuses holder, AC noise filter and power board. The AC inlet, AC switch, fuses holder and AC noise filter are contained in one component. The power board consists of the AC voltage selection switch, battery charging circuit, power operation mode circuit and regulator.

AC Voltage Selection Switch

The setting of this switch enables the POWER BD to accept 110 V, 115 to 127 V or 220 to 240 V.

Battery Charging Circuit

This circuit uses a switching regulator to charge the battery.

Power Operation Mode Circuit

This circuit switches the power operation mode of the instrument. If the AC power supply is available, the instrument automatically uses the AC power supply. If the AC power is not available, the instrument automatically uses the battery power supply if the battery voltage is above 10.8 V. During battery operation mode, this circuit shuts down the instrument if the battery voltage falls below 10.8 V.

Regulator

This regulator outputs the following voltages:

	Description
+24 V	For thermal head
+12.6 V	For writing the flash RAM
−8 V	For analog circuit
+5 V	For digital circuit
5 V	For isolation transformer

5-7 Recorder Unit

This unit consists of:

1) a A4 size 200 dpi thermal head
2) a paper mark detection and paper empty sensors for detecting the paper mark and paper empty.
3) a motor that feeds the recording paper.
4) a magazine whose paper width can be changed from 210 mm to 216 mm.

5-8 LCD Module

This is a 10.4 inches 640×480 dot LCD display. A 12×14 matrix touch panel is placed in front of the LCD module to give the touch screen operation.

5-9 Extension I/O Board

This board has two types of input and output ports. The first type of input and output ports has a photo-isolated two-channel RS-232C interface that can transmit at 1200 to 9600 baud rate. The second type of input and output ports has six channels for analog signals.

5-10 Slave Monitor Interface

This board has one photo-isolated output port for the slave monitor.

Section 6 DISASSEMBLY AND ASSEMBLY

6-1 SLAVE MONITOR BD 6.4
6-2 EXTENSION I/O BD 6.8
6-3 Top Casing 6.12
6-4 CONTROL BD 6.15
6-5 Battery 6.18
6-6 Power Unit 6.20
6-7 POWER BD 6.22
6-8 Lithium Battery 6.23
6-9 LCD Panel Rear Cover 6.26
6-10 LCD KEY BD 6.28
6-11 LCD Panel Front ASSY 6.30
6-12 Touch Panel ASSY 6.31
6-13 LCD Module 6.32
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6-15 Thermal Head 6.34
6-16 Motor ASSY 6.36
6-17 Motor-gear Base ASSY 6.38
6-18 Magazine Release Lever 6.39
6-19 Platen Roller ASSY 6.40
6-20 Rear Panel Base 6.42
6-21 Input Box and Electrode Leads Cartridge 6.43
6-22 Fuse 6.44
6-22-1 AC Main Fuse 6.45
6-22-2 Battery Fuse 6.46
6-22-3 POWER BD Fuse 6.47
6-22-4 LCD KEY BD Fuse 6.48
6-23 Floppy Disk Unit 6.49
6-24 Magnetic Card Reader 6.53
6-25 Extend Memory Module SIMM 6.55

The procedures in this section tell how to remove, replace and install major components.

Before You Begin

Removing, replacing and installing major components should be done by a qualified service personnel.

WARNING

- **To avoid the possibility of injury to yourself or damage to the instrument, do not install or remove any component or change switch settings while your instrument is on. Therefore, switch off the power switch on the operation panel and the main power switch on the rear panel, and unplug the AC power cord before disassembling the instrument.**
- **To avoid accidental discharge of static electricity, which could damage instrument components, use a grounded wrist strap when installing or removing any component of the instrument.**

CAUTION

- **Before connecting or disconnecting a cable, shut down the instrument and unplug the power cord from the instrument.**
- **To avoid possible damage to the instrument disconnect all patient cables (electrodes) from the instrument to a patient undergoing defibrillation.**
- **Fuses cut off the power when an abnormality occurs in the instrument. Eliminate the malfunction before replacing the fuse. Use the correct fuse only. The fuse rating is shown at the holder.**

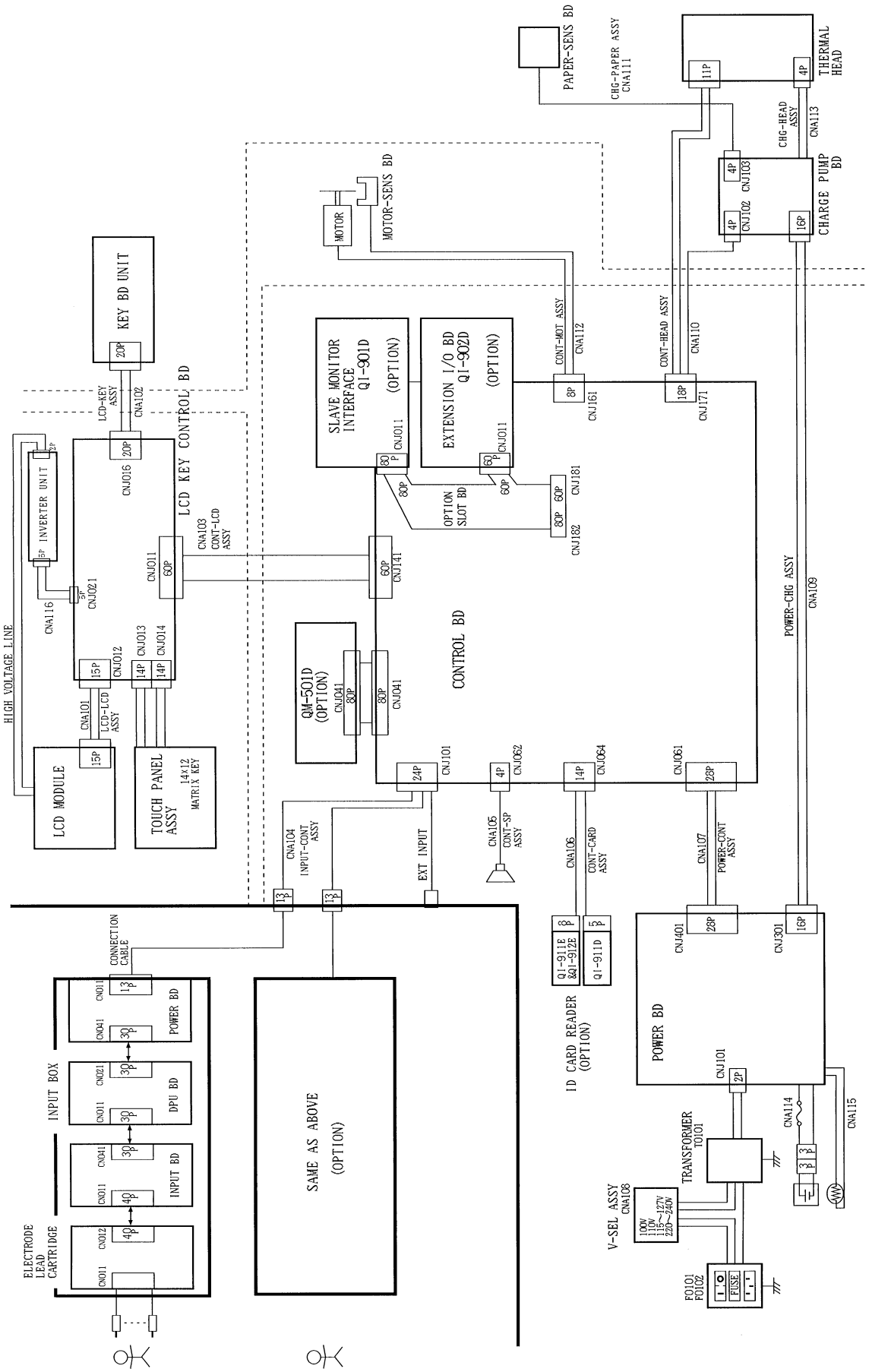
Required Tools

Anti-static bench mat
Anti-static wrist strap
Flat-blade screwdriver (insulated type)
Phillips screwdriver (insulated type)
Standard Hex (Allen) wrench or Hexagon keys
Tweezers
Nipper

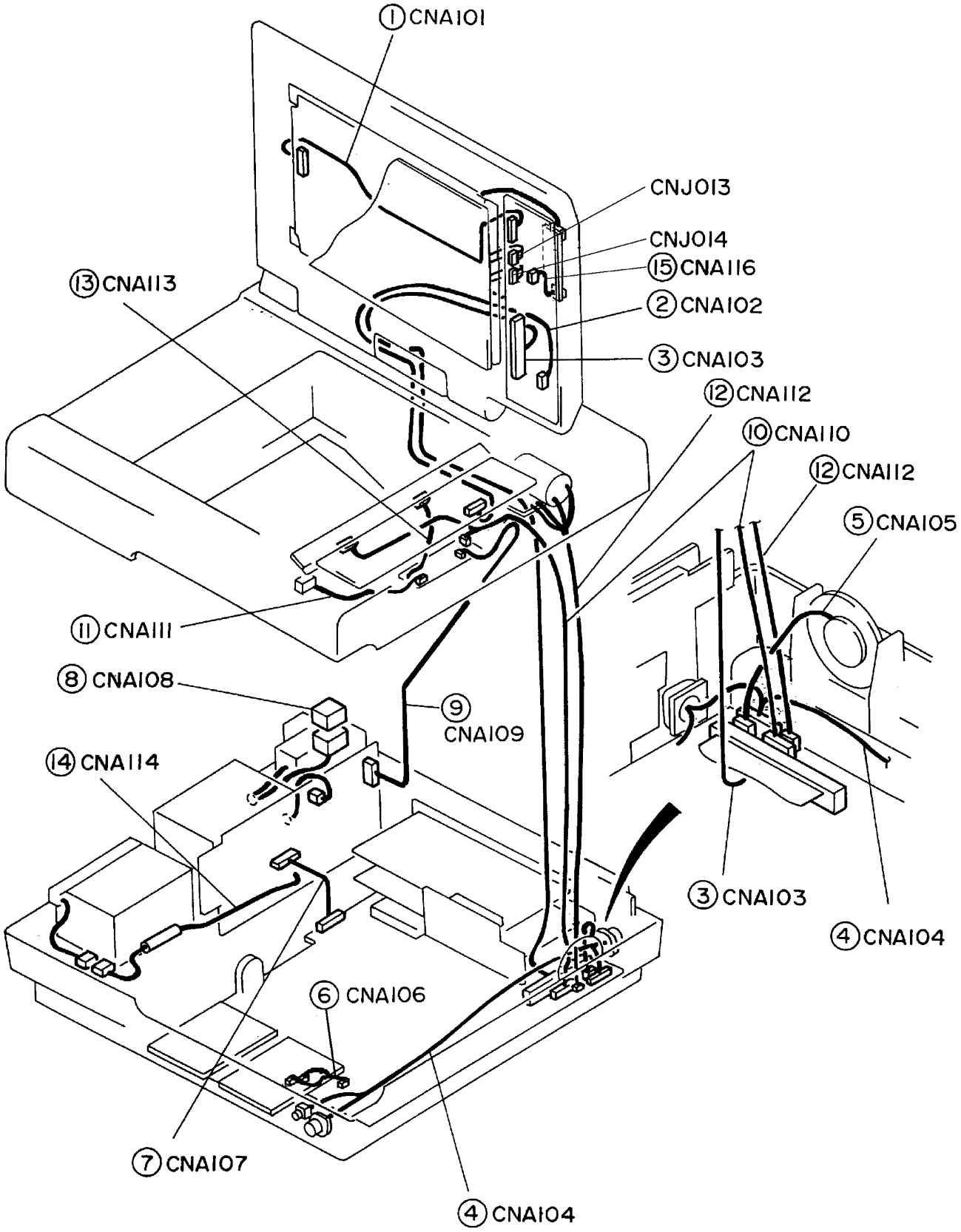
Cable Connection

The following connection diagram and cable connection illustration show the location and connection of the cables in the instrument.

Connecting Diagram



Cable Connection



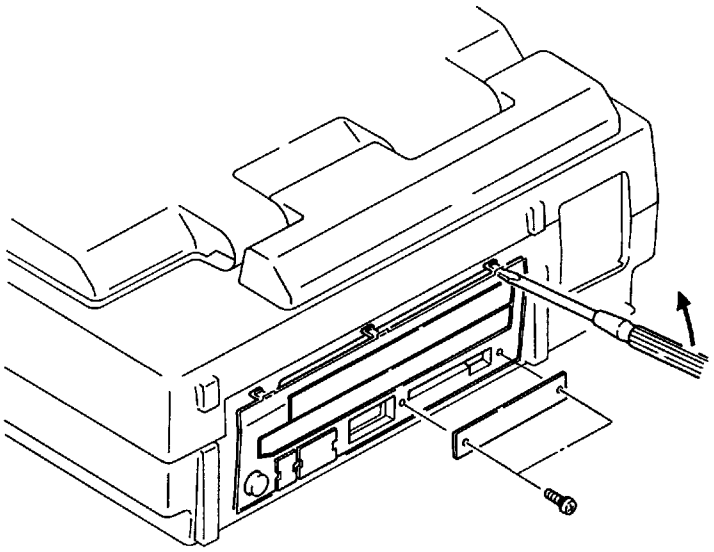
6-1 SLAVE MONITOR BD

Removal

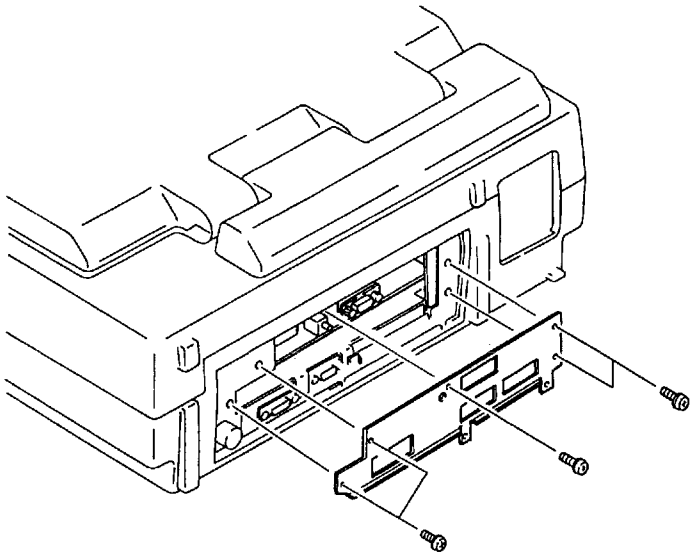
1. Read the precautions at the beginning of this section.

2. If the IC card slot at the rear panel is covered, remove the two screws which attach the IC card slot cover to the bottom casing.

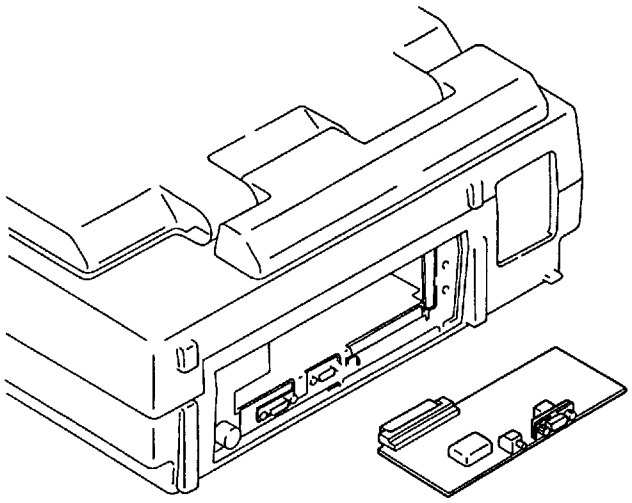
3. Using a flat-blade screwdriver, pry off the rear panel from the bottom casing.



4. Remove the five screws which attach the optional board cover to the bottom casing.



5. Pull out the optional SLAVE MONITOR BD from its optional slot.



Replacement

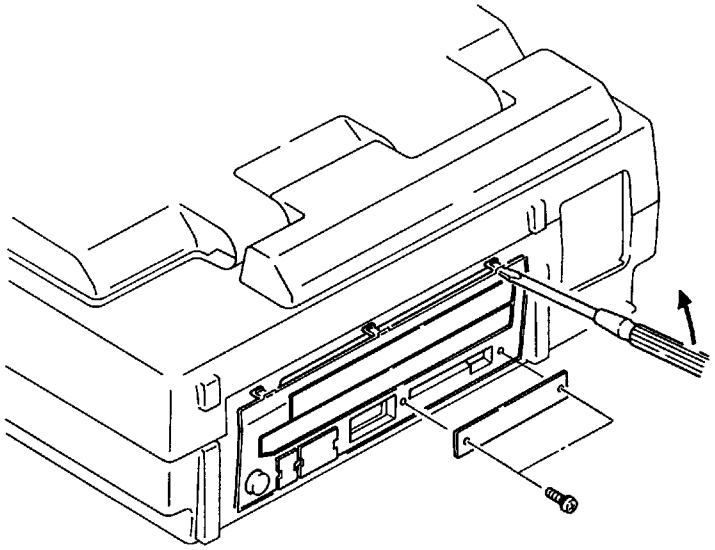
1. Reinsert the optional SLAVE MONITOR BD to its optional slot in the bottom casing.
2. Reattach the optional board cover with the five screws.
3. Reinsert the rear panel.
4. If necessary, reattach the IC card slot cover with the two screws.

Installment

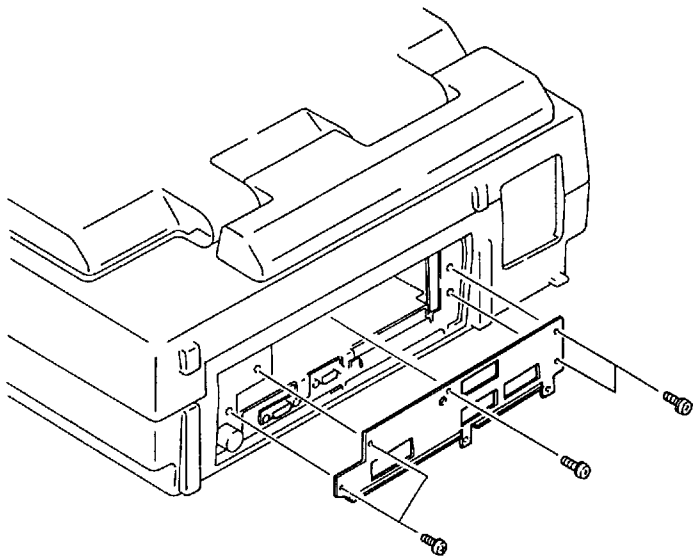
1. Read the precautions at the beginning of this section.

2. If the IC card slot at the rear panel is covered, remove the two screws which attach the IC card slot cover to the bottom casing.

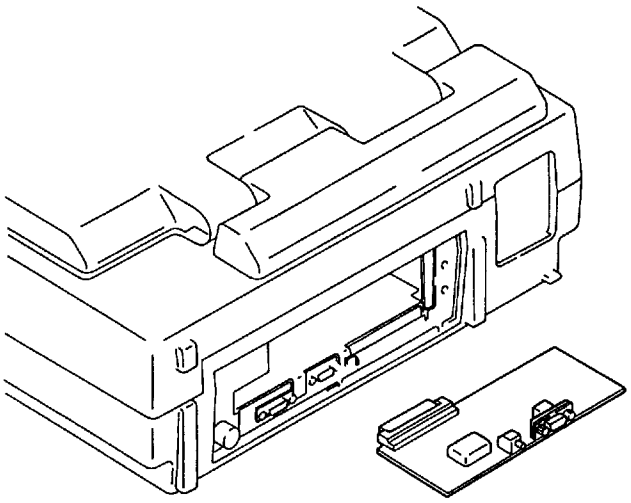
3. Using a flat-blade screwdriver, pry off the rear panel from the bottom casing.



4. Remove the five screws which attach the optional board cover to the bottom casing.

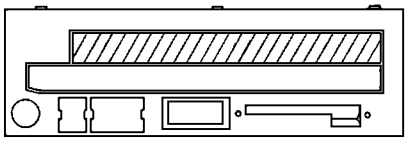


5. Insert the optional SLAVE MONITOR BD to top optional slot in the bottom casing.



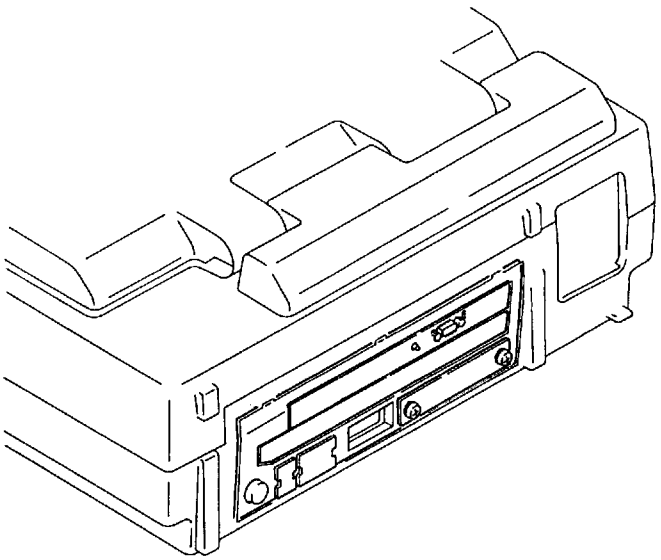
6. Reattach the optional board cover with the five screws.

7. Use a nipper to break the shaded part of the rear panel.



8. Reinsert the rear panel.

9. If necessary, reattach the IC card slot cover with the two screws.



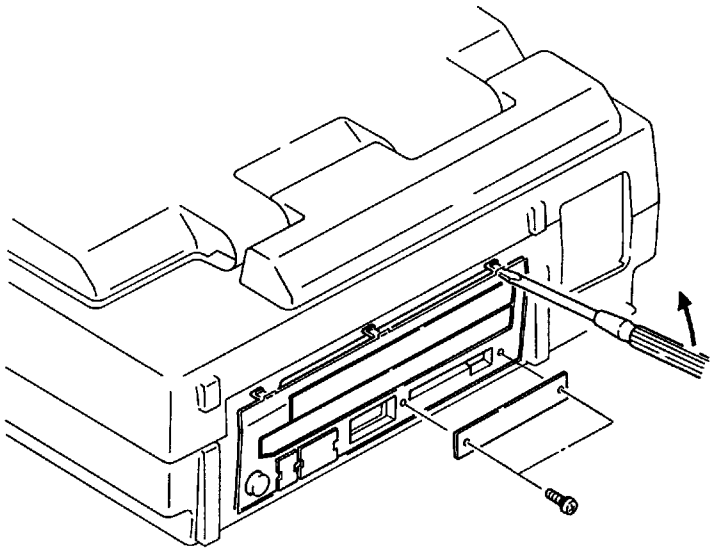
6-2 EXTENSION I/O BD

Removal

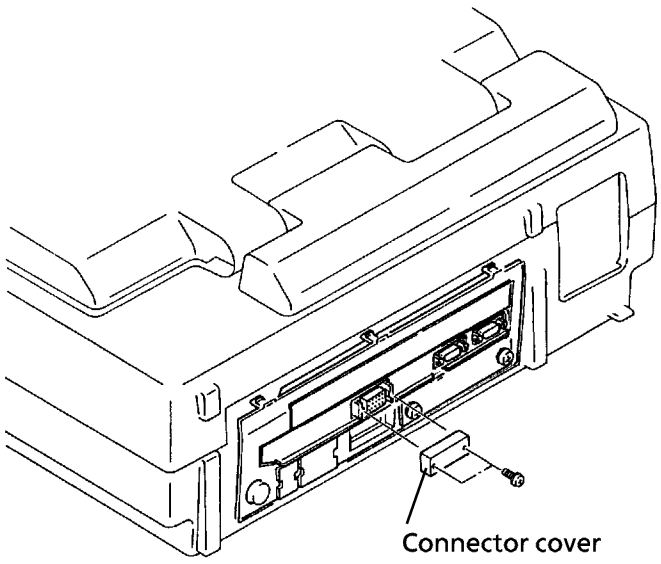
1. Read the precautions at the beginning of this section.

2. If the IC card slot at the rear panel is covered, remove the two screws which attach the IC card slot cover to the bottom casing.

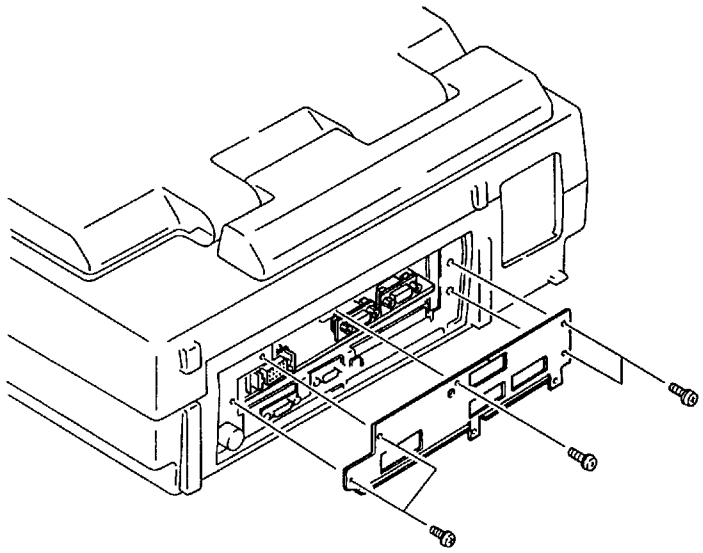
3. Using a flat-blade screwdriver, pry off the rear panel from the bottom casing.



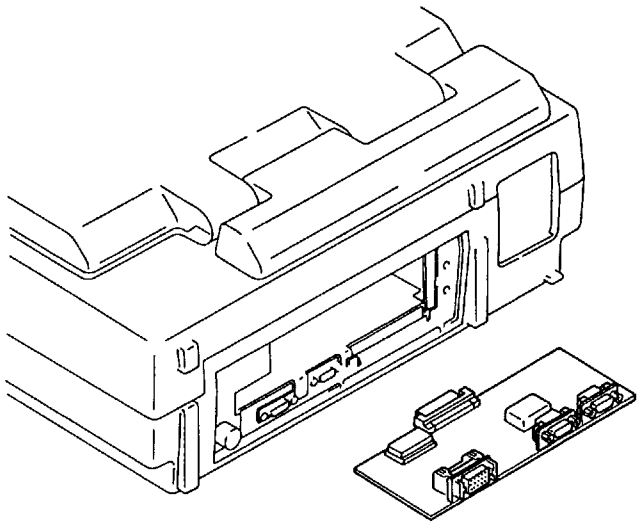
4. Remove the two screws which attach the connector cover to the EXTENSION I/O BD.



5. Remove the five screws which attach the optional board cover to the bottom casing.



6. Pull out the optional EXTENSION I/O BD from its optional slot.



Replacement

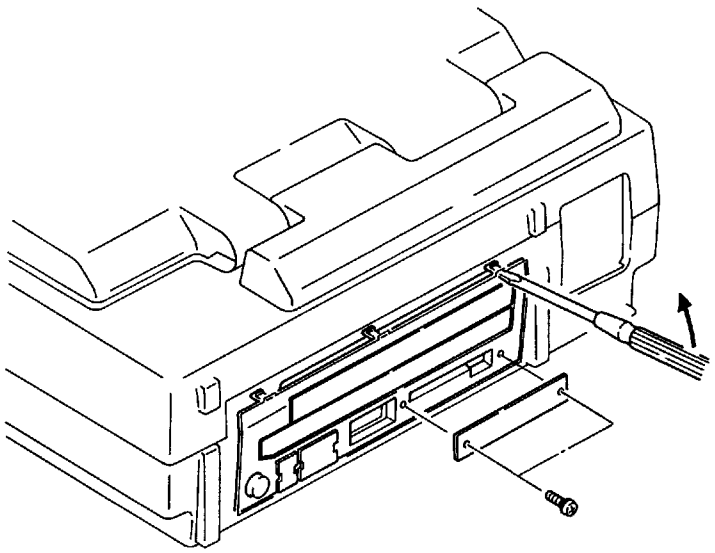
1. Reinsert the optional EXTENSION I/O BD to its optional slot in the bottom casing.
2. Reattach the optional board cover with the five screws.
3. Reattach the connector cover with the two screws.
4. Reinsert the rear panel.
5. If necessary, reattach the IC card slot cover with the two screws.

Installment

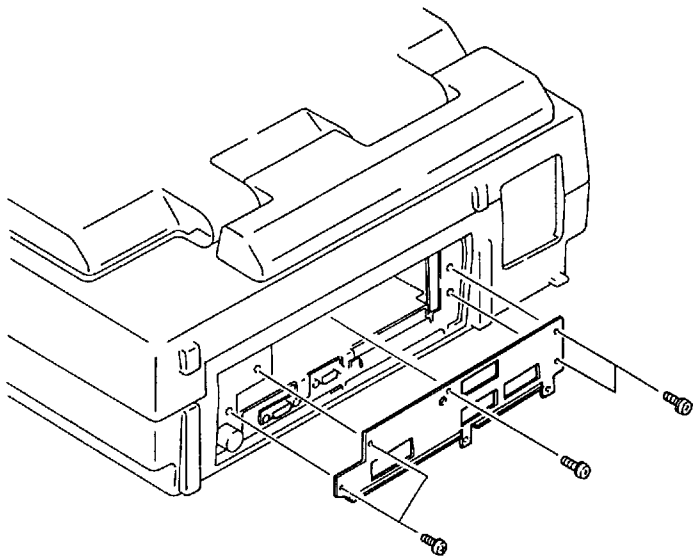
1. Read the precautions at the beginning of this section.

2. If the IC card slot at the rear panel is covered, remove the two screws which attach the IC card slot cover to the bottom casing.

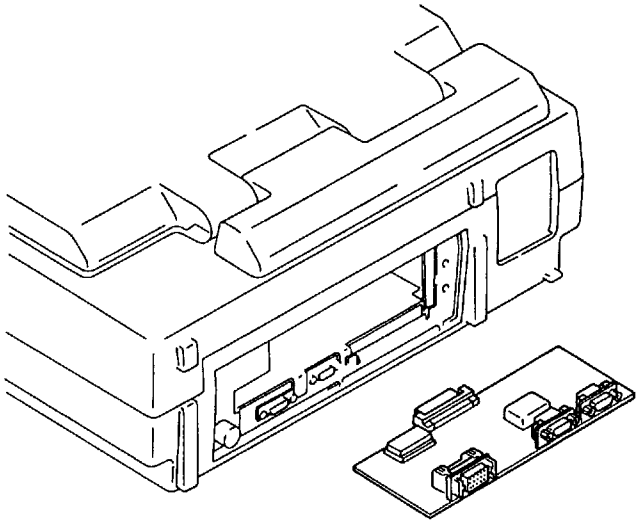
3. Using a flat-blade screwdriver, pry off the rear panel from the bottom casing.



4. Remove the five screws which attach the optional board cover to the bottom casing.

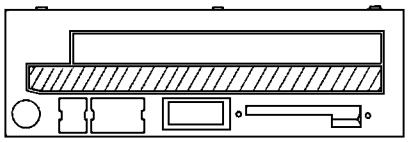


5. Insert the optional EXTENSION I/O BD to top optional slot in the bottom casing.



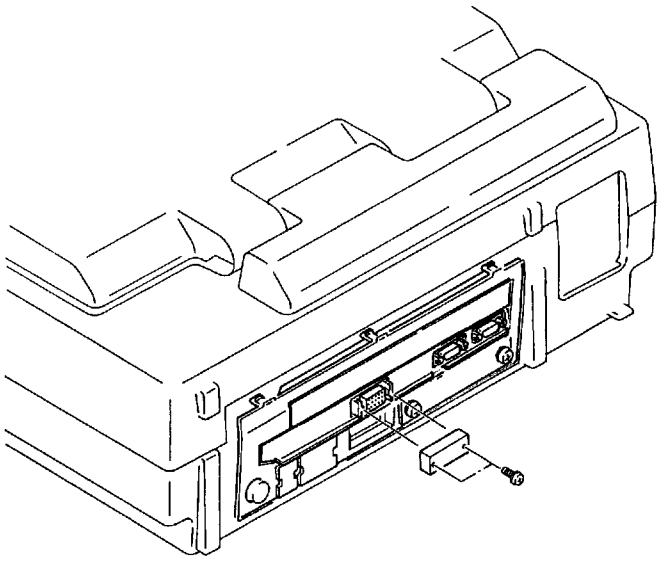
6. Reattach the optional board cover with the five screws.

7. Use a nipper to break the shaded part of the rear panel.



8. Reinsert the rear panel.

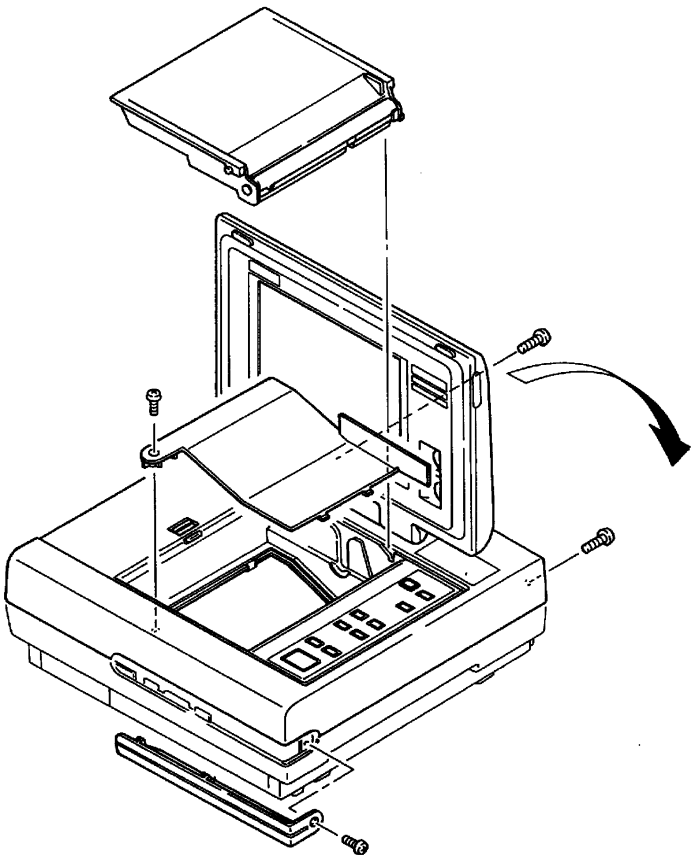
9. If necessary, reattach the connector cover with the two screws.



6-3 Top Casing

Disassembly

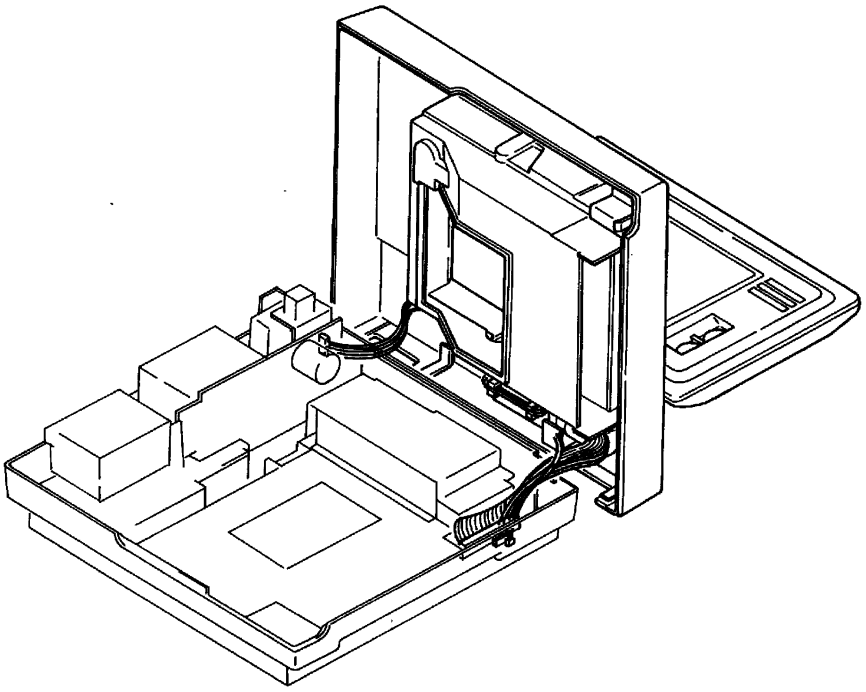
1. Read the precautions at the beginning of this section.
2. Slide the magazine release lever to detach the magazine from the instrument.
3. Remove the screw which attaches the recorder base cover to the instrument.
4. Remove the three screws which attach the top casing to the bottom casing.



5. While facing the open LCD panel, slowly lift up the front part of the top casing until the open LCD panel becomes parallel to the ground.

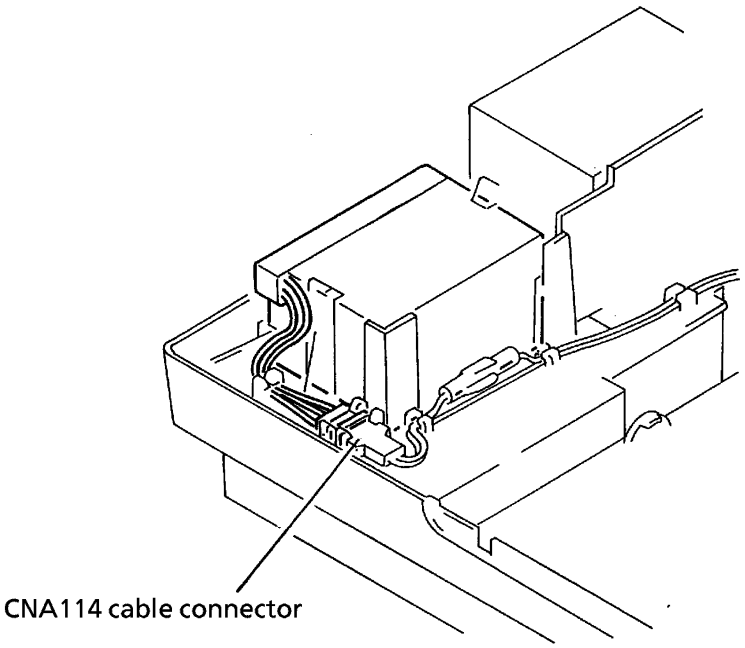
NOTE

There are four cables connecting the top casing to the bottom casing.



6. Put down the top casing with the opened LCD panel at the back of the instrument.

7. Disconnect the CNA114 cable from the battery.



8. The CNA103, CNA109, CNA110 and CNA112 cables are bound together by a ferrite core. Remove the cables from this ferrite core, then disconnect them from the CONTROL BD.

Assembly

1. Reconnect the CNA103, CNA109, CNA110 and CNA112 cables to the bottom casing.
2. Reconnect the CNA114 cable to the battery.
3. Reattach the top casing to the bottom casing with the three screws.
4. Reattach the recorder base cover with the screw.
5. Reattach the magazine to the instrument.

6-4 CONTROL BD

NOTE

The settings displayed in the SYSTEM SETUP screen may be changed when the CONTROL BD is replaced. Therefore, print out the settings of the instrument before replacing this board so that you can set back the same settings after the board is replaced. Refer to the "Changing Settings Before Measurement" section of the Operator's Manual for the procedure to print the settings list.

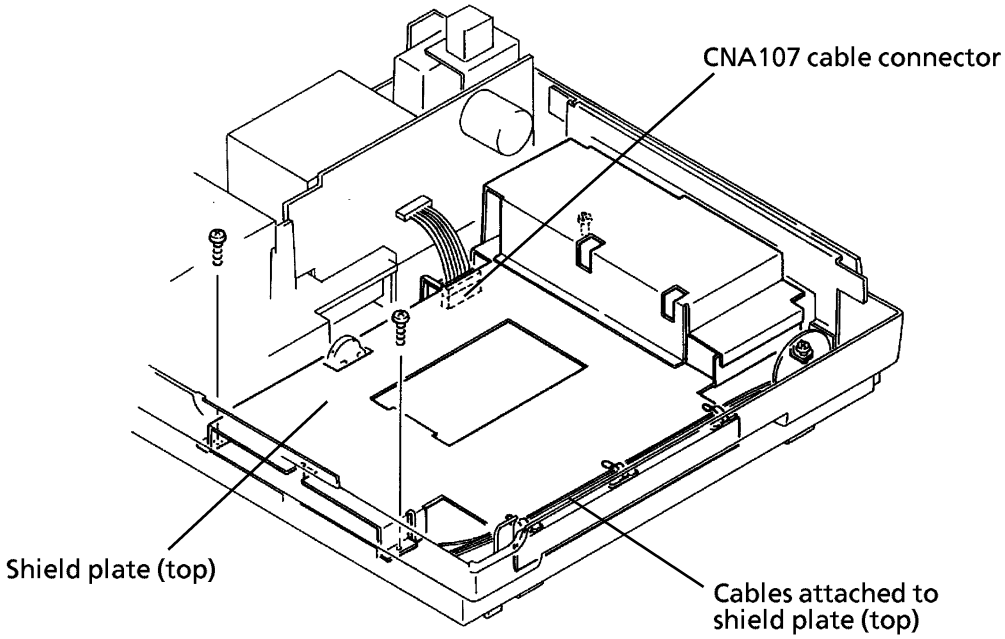
Removal

1. Read the precautions at the beginning of this section.

2. Detach the top casing from the bottom casing as described in the "Top Casing" subsection.

3. If the SLAVE MONITOR BD and EXTENSION I/O BD are installed, remove them from the instrument by following the procedures in the "SLAVE MONITOR BD" and "EXTENSION I/O BD" subsections.

4. Remove the two front screws and loosen the two rear screws which attach the shield plate (top) to the CONTROL BD.



5. Disconnect the CNA107 cable from the CONTROL BD.

6. Remove the cables from the shield plate (top).

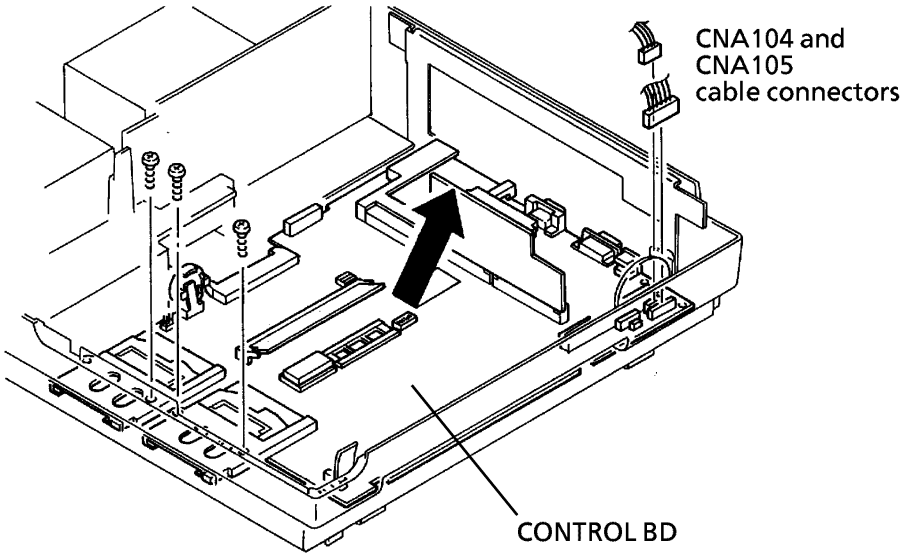
7. Slowly lift the shield plate (top) of the bottom casing.

8. Remove the three screws which attach the CONTROL BD to the bottom casing.

9. If the magnetic card reader is installed, disconnect the CNA106 cable from the CONTROL BD.

10. Disconnect the CNA104 and CNA105 cables from the CONTROL BD.

11. While facing the front of the bottom casing, slightly move the CONTROL BD toward you, and then lift the far edge of the CONTROL BD (the edge at the rear bottom casing) until the whole CONTROL BD clears the bottom casing.



Replacement

1. First lower the front edge of CONTROL BD into the bottom casing and then the rear edge to place the CONTROL BD into the bottom casing.

2. Reconnect the CNA104 and CNA105 cables to the CONTROL BD.

3. If the magnetic card reader is installed, reconnect the CNA106 cable to the CONTROL BD.

4. Reattach the CONTROL BD with the three screws.

5. Replace the shield plate (top) on top of the CONTROL BD.

6. Reattach the cables to the shield plate (top).

7. Reconnect the CNJ104 cable to the CONTROL BD.

8. Replace the two front screws and tighten the two rear screws to attach the shield plate (top) to the CONTROL BD.

9. If the SLAVE MONITOR BD and EXTENSION I/O BD were installed, reinstall it to the instrument by following the procedures in the "SLAVE MONITOR BD" and "EXTENSION I/O BD" subsections.

10. Reattach the top casing to the bottom casing as described in the "Top Casing" subsection.

6-5 Battery

ATTENTION

This is a rechargeable and recycleable battery. Depending on the local laws in your community, it may be illegal to dispose of this battery in the regular waste collection. Check with your local officials for recycling options or proper disposal.

CAUTION

Before disposing of the battery, check with your local solid waste officials for details in your area for recycling options or proper disposal. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into municipal waste stream.

NOTE

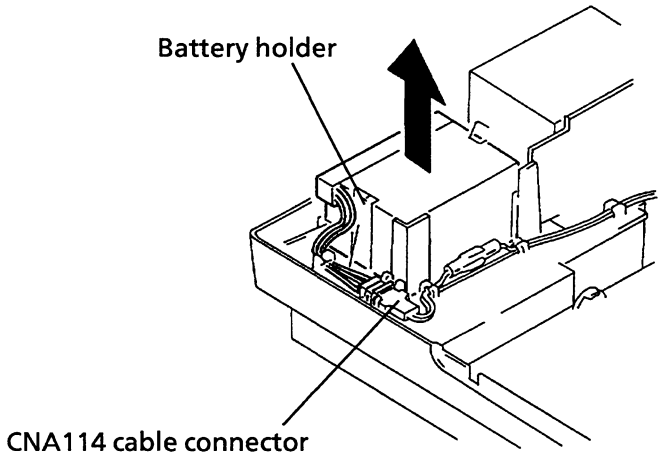
- **Replace the battery when it cannot last for 30 minutes during battery operation at the temperatures between 20 and 30°C.**
- **After putting a new battery in the instrument, charge it for at least 10 hours in order to make it fully charged.**

Removal

1. Read the precautions at the beginning of this section.

2. Detach the top casing from the bottom casing as described in steps 2 through 7 of the "Top Casing" subsection.

3. Disconnect the CNA114 cable from the battery.



4. Press the two battery holders outward to detach the battery from the bottom casing.

Replacement

1. Reattach the battery to the bottom casing.

NOTE

There is the possibility that when the CNA114 battery cable connector is connected, the instrument power turnes on. This is normal.

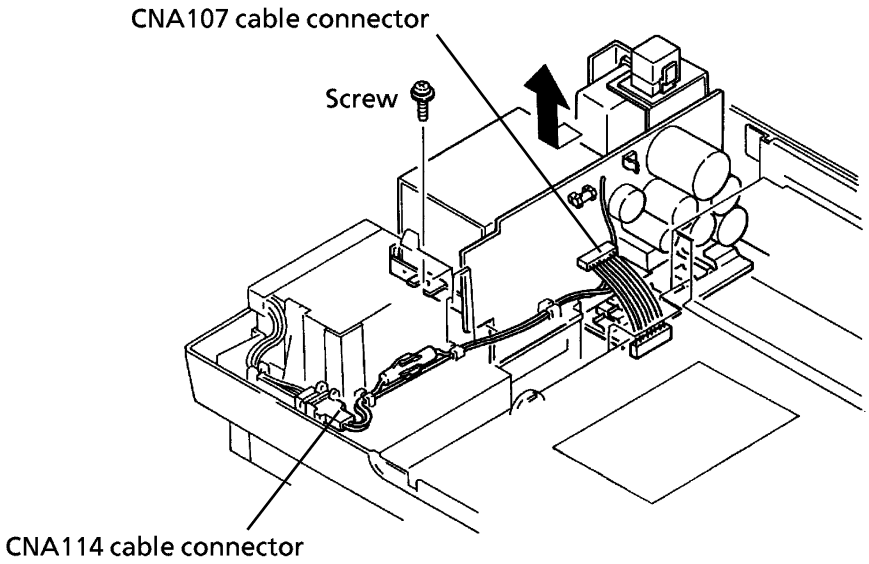
2. Reconnect the CNA114 to the battery.

3. Reattach the top casing to the bottom casing as described in steps 2 through 5 of the "Top Casing" subsection.

6-6 Power Unit

Removal

1. Read the precautions at the beginning of this section.
2. Detach the top casing from the bottom casing as described in steps 2 through 7 of the "Top Casing" subsection.
3. Remove the battery from the bottom casing as described in the "Battery" subsection.
4. Disconnect the CNA114, CNA107, CNA109 and CNA115 from the POWER BD.



5. Remove the screw which attaches the power unit to the bottom casing.
6. While facing the front of the bottom casing, slightly slide the power unit toward you and then lift the power unit until it clears the bottom casing.

NOTE

There are two hooks holding the power unit to the bottom casing.

Replacement

1. Lower the power unit into the bottom casing and slide it toward the rear of the bottom casing.

2. Reattach the power unit with the screw.

3. Reconnect the CNA114, CNA107, CNA109 and CNA115 to the POWER BD.

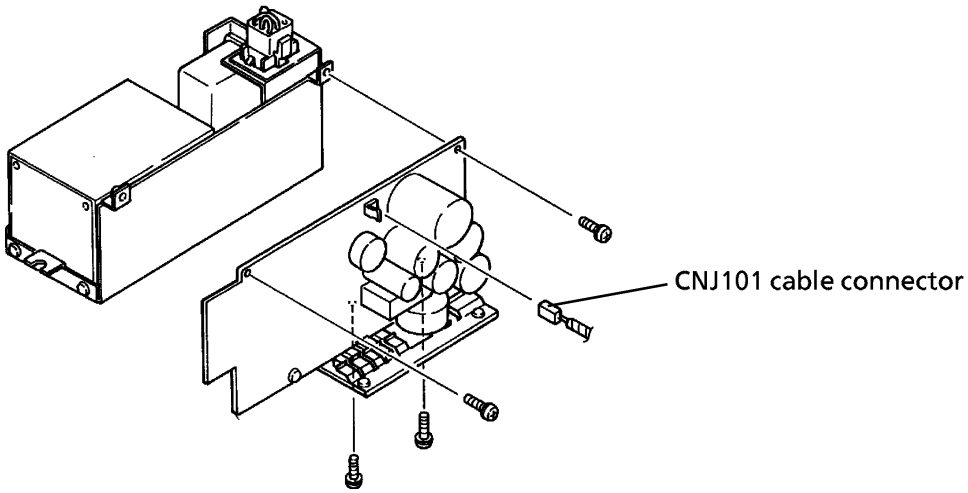
4. Replace the battery to the bottom casing as described in the "Battery" subsection.

5. Reattach the top casing to the bottom casing as described in steps 2 through 5 of the "Top Casing" subsection.

6-7 POWER BD

Removal

1. Read the precautions at the beginning of this section.
2. Detach the power unit from the bottom casing as described in the "Power Unit" subsection.
3. Disconnect the CNJ101 cables from the POWER BD.



4. Remove the four screws which attach the POWER BD to the power unit.

Replacement

1. Reattach the POWER BD with the four screws.
2. Reconnect the CNJ101 cable to the POWER BD.
3. Reattach the power unit to the bottom casing as described in the "Power Unit" subsection.

6-8 Lithium Battery

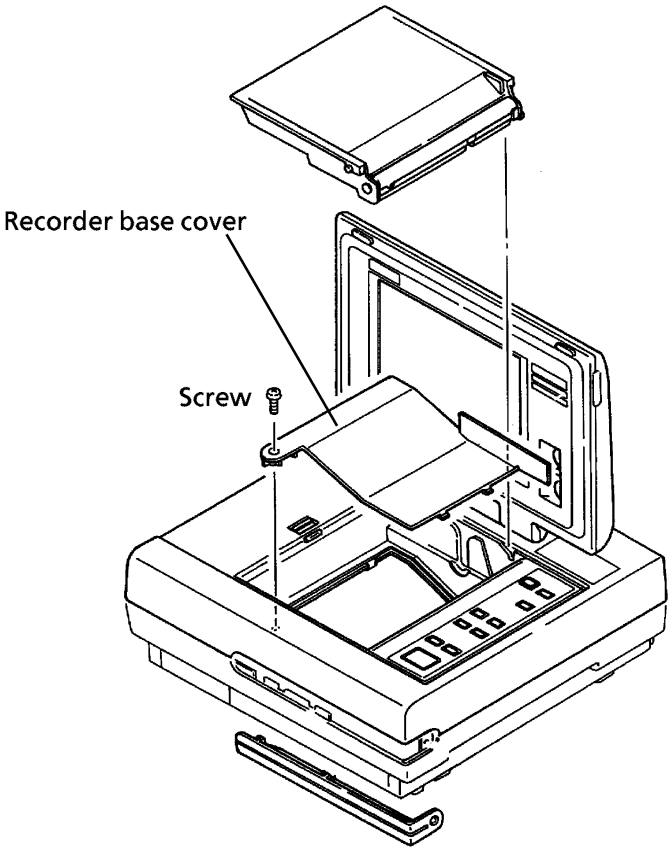
CAUTION

- **The lithium battery in this instrument can be replaced while the instrument is on or off. Replacing the lithium battery while the instrument is off resets the system setup settings to the default settings, but replacing the lithium battery while the instrument is on does not reset the system setup settings.**
- **If the lithium battery is replaced while the instrument is on, be careful not to short the two terminals of the lithium battery holder because this can damage the lithium battery.**
- **Make sure you are electrostatically grounded before touching the lithium battery.**

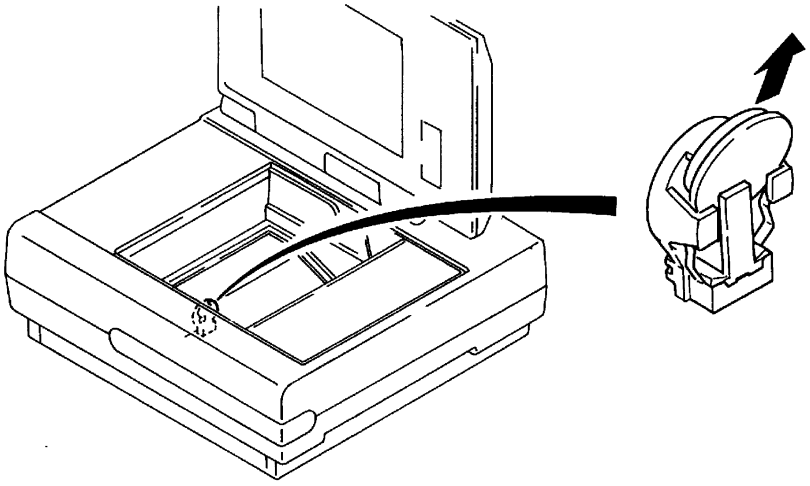
Removal

1. Read the precautions at the beginning of this section.
2. Slide the magazine release lever to detach the magazine from the instrument.
3. Remove the screw which attaches the recorder base cover to the chassis of the instrument.

4. Lift the recorder base cover off the chassis of the instrument.



5. Detach the lithium battery from the holder with your fingers and thumb.



Replacement

1. Insert the lithium battery into the lithium battery holder with the positive side of the lithium battery in contact with the positive marked terminal of the holder.

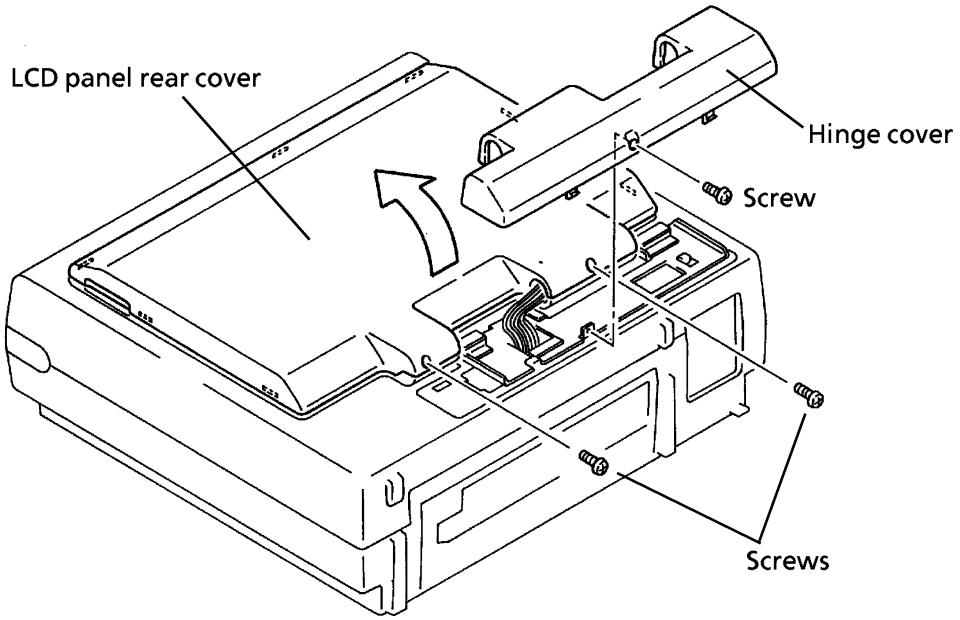
2. Reattach the recorder base cover to the chassis of the instrument with the screw.

3. Reattach the magazine to the instrument.

6-9 LCD Panel Rear Cover

Removal

1. Read the precautions at the beginning of this section.
2. If the LCD panel is opened, close it.
3. Remove the screw which attaches the hinge cover to the chassis of the instrument.
4. Lift the hinge cover off the chassis of the instrument.
5. Remove the two screws which attach the LCD panel rear cover to the back of the LCD panel.
6. Lift the bottom edge of the LCD panel rear cover, as shown on the illustration below, to remove the LCD panel rear cover from the back of the LCD panel.



Replacement

1. Place the LCD panel rear cover on the back of the LCD panel.
2. Reattach the LCD panel rear cover with the two screws.
3. Place the hinge cover over the hinges of the LCD panel.
4. Reattach the hinge cover with the screw.

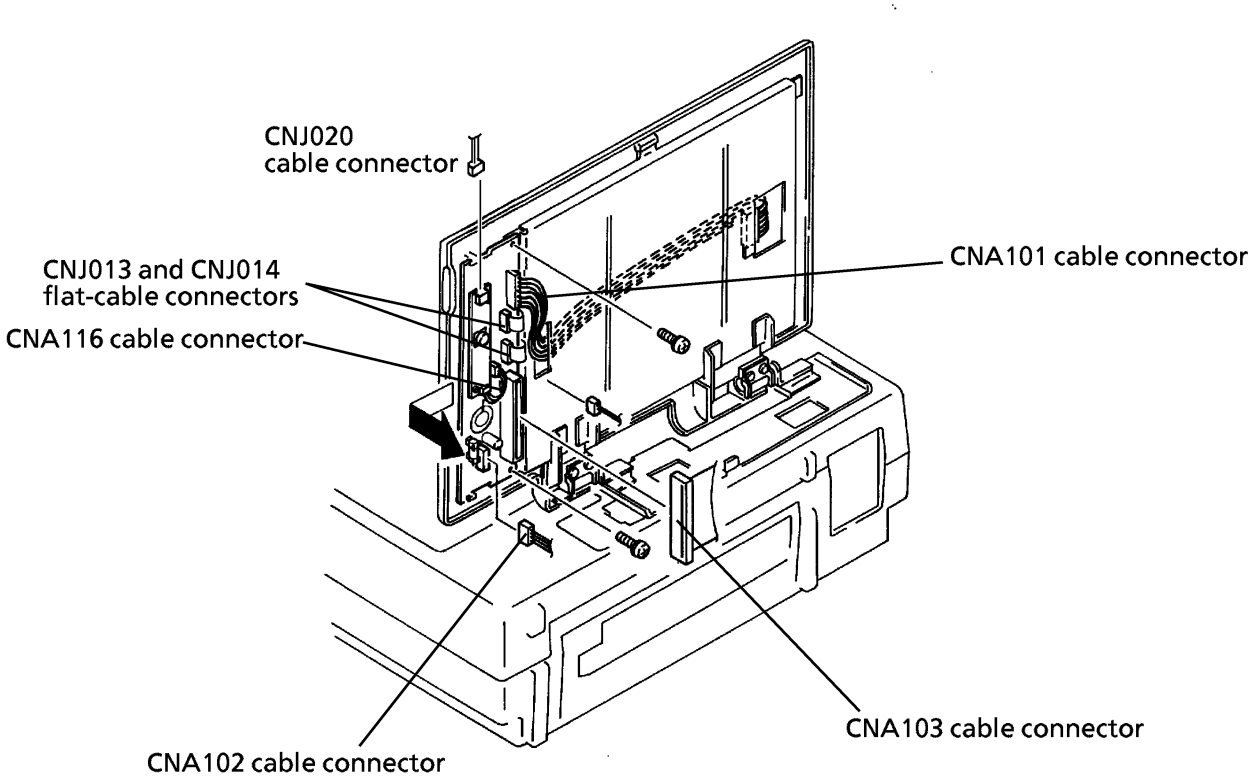
6-10 LCD KEY BD

Removal

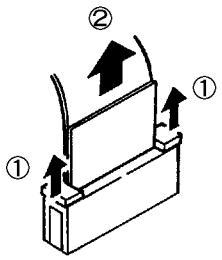
1. Read the precautions at the beginning of this section.

2. Detach the LCD panel rear cover as described in the "LCD Panel Rear Cover" subsection.

3. Disconnect the CNA101, CNA102 and CNA103 cables and a dual white cable (from the CNJ020 of the LCD KEY BD) from the LCD KEY BD.



4. Disconnect the CNJ013 and CNJ014 flat-cables by first unlocking the flat-cable connector lock by lifting the lock up and then pulling the flat-cable out of the flat-cable connector.

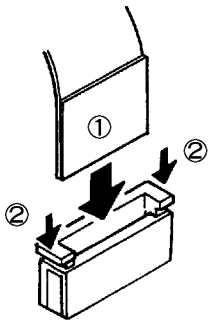


5. Remove the two screws which attach the LCD KEY BD to the LCD panel.

Replacement

1. Reattach the LCD KEY BD with the two screws.

2. Reconnect the CNJ013 and CNJ014 flat-cables to the flat-cable connector by first inserting the flat-cable to the flat-cable connector, and then pressing down the flat-cable connector lock to lock the flat-cable connector.



3. Reconnect the CNA101, CNA102 and CNA103 cables and the dual white cable (from the CNJ020 of the LCD KEY BD) to the LCD KEY BD.

4. Reattach the LCD panel rear cover as described in the "LCD Panel Rear Cover" subsection.

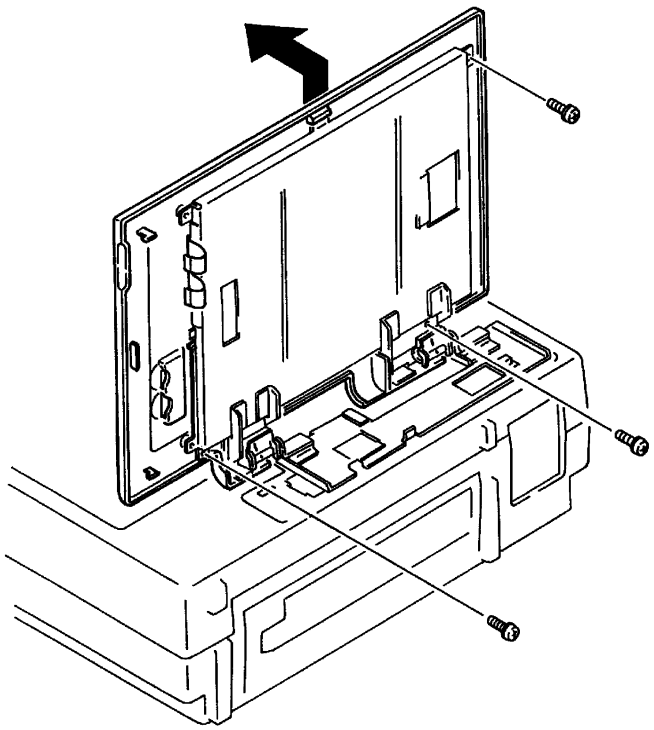
6-11 LCD Panel Front ASSY

Removal

1. Read the precautions at the beginning of this section.

2. Detach the LCD panel rear cover and LCD KEY BD as described in the "LCD Panel Rear Cover" and "LCD KEY BD" subsections.

3. Remove the three screws which attach the LCD panel front ASSY to the LCD ASSY.



4. While facing the LCD screen, slightly lift the LCD panel front ASSY upward and then pull the LCD panel front ASSY toward you until it clears the LCD ASSY.

Replacement

1. Reattach the LCD panel front ASSY onto the LCD ASSY with the three screws.

2. Reattach the LCD KEY BD and LCD panel rear cover as described in the "LCD KEY BD" and "LCD Panel Rear Cover" subsections.

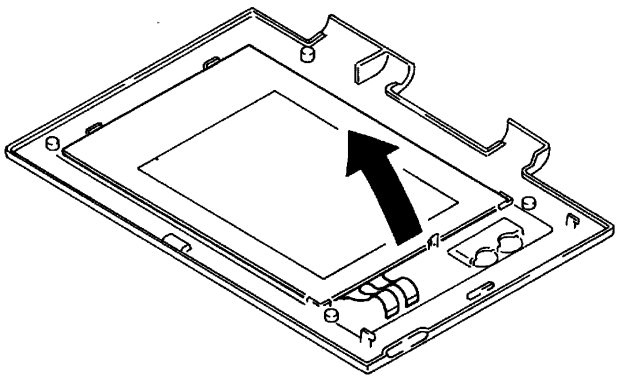
6-12 Touch Panel ASSY

Removal

1. Read the precautions at the beginning of this section.

2. Detach the LCD panel rear cover, LCD KEY BD and LCD panel front ASSY as described in the "LCD Panel Rear Cover", "LCD KEY BD" and "LCD Panel Front ASSY" subsections.

3. Unhook the touch screen from the LCD panel front ASSY.



Replacement

1. Rehook the touch screen to the LCD panel front ASSY.

2. Reattach the LCD panel front ASSY, LCD KEY BD and LCD panel rear cover as described in the "LCD Panel Front ASSY", "LCD KEY BD" and "LCD Panel Rear Cover" subsections.

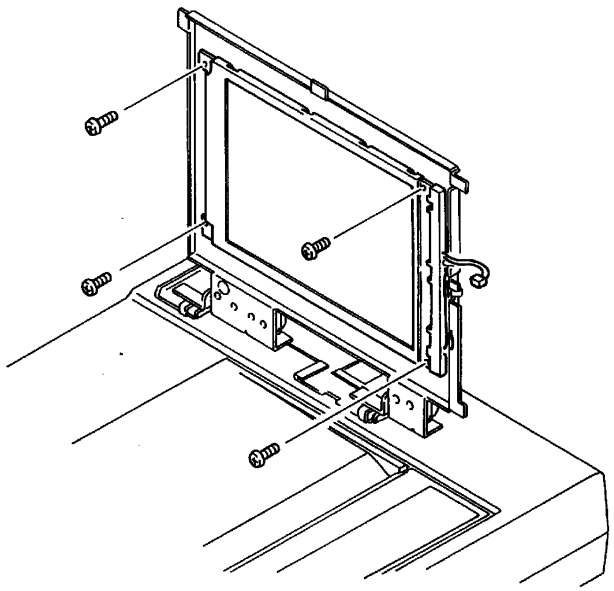
6-13 LCD Module

Removal

1. Read the precautions at the beginning of this section.

2. Detach the LCD panel rear cover, LCD KEY BD and LCD panel front ASSY as described in the "LCD Panel Rear Cover", "LCD KEY BD" and "LCD Panel Front ASSY" subsections.

3. Remove the four screws which attach the LCD module to the LCD base plate.



Replacement

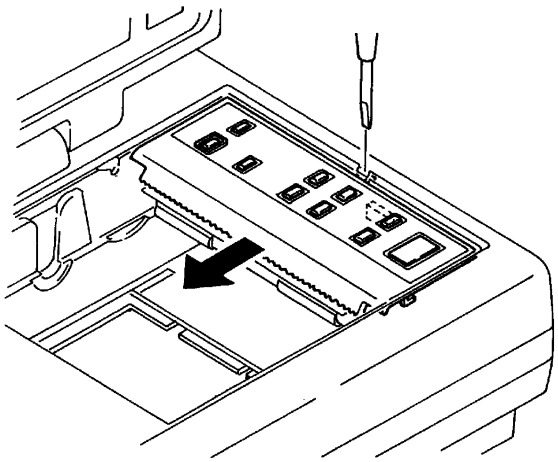
1. Reattach the LCD module with the four screws.

2. Reattach the LCD panel front ASSY, LCD KEY BD and LCD panel rear cover as described in the "LCD Panel Front ASSY", "LCD KEY BD" and "LCD Panel Rear Cover" subsections.

6-14 Operation Panel Cover

Removal

1. Read the precautions at the beginning of this section.
2. Slide the magazine release lever to detach the magazine from the instrument.
3. Using a flat blade screwdriver, depress the hook of the operation panel cover below the level of the hole, and with the other hand, pull the paper cutting edge of the operation panel cover away from the hole.



4. Disconnect the CNA102 cable from the KEY BD.

Replacement

1. Reconnect the CNA102 cable to the KEY BD.
2. Insert the operation panel cover until the hook on the operation panel cover juts out of the hole.
3. Reattach the magazine to the instrument.

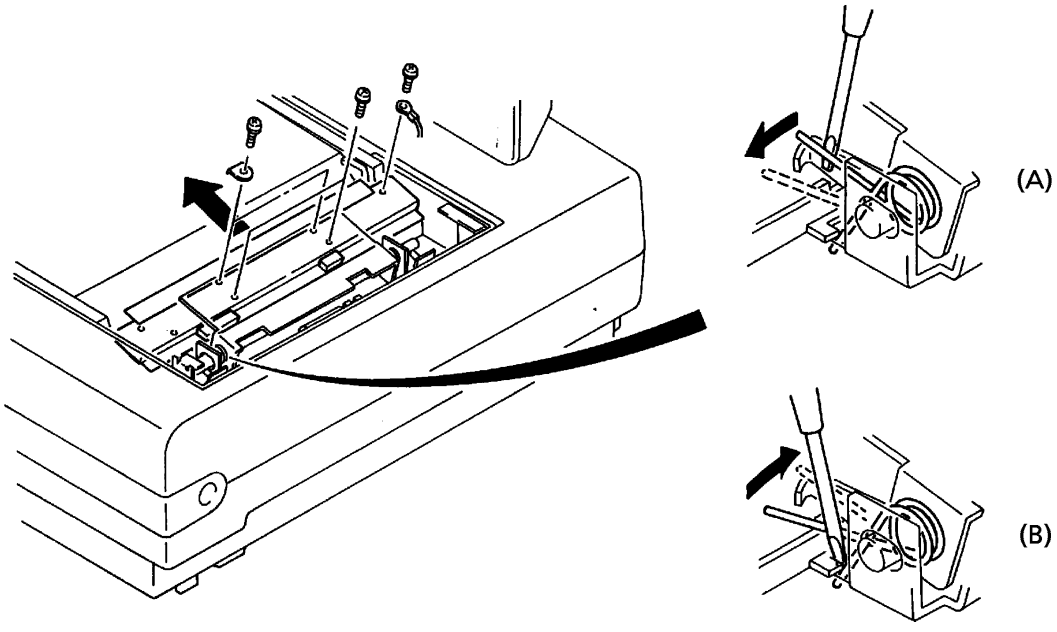
6-15 Thermal Head

NOTE

The recording density of the thermal head depends on the thermal head resistance value. This value differs from one thermal head to another. Therefore, reset this thermal head resistance setting each time the thermal head is replaced. Failure to do this may cause the recording to be too faint or too dark. Refer to the "Thermal Head Resistance Setting" subsection of Section 7 for setting the thermal head resistance.

Removal

1. Read the precautions at the beginning of this section.
2. Slide the magazine release lever to detach the magazine from the instrument.
3. Detach the operation panel cover as described in steps 3 and 4 of the "Operation Panel Cover" subsection.
4. Reattach the magazine to the instrument.
5. While facing the instrument, use a flat-blade screwdriver to depress the front TH spring toward you to release the thermal head from the front TH spring. (Refer to the illustration A below.)



6. Repeat step 4 for the rear TH spring.
7. Remove the four screws which attach the thermal head to the recorder unit.
8. Disconnect the CNA110 and CNA113 cables from the thermal head.

Replacement

1. Reconnect the CNA110 and CNA113 cables to the thermal head.

2. Reattach the thermal head with the four screws.

3. While facing the instrument, insert a flat-blade screwdriver into the hole of the paper feeder base plate and then push the screwdriver away from you to hook the front TH spring to the thermal head. (Refer to the illustration B on the previous page.)

4. Repeat step 3 for the rear TH spring.

5. Slide the magazine release lever to detach the magazine from the instrument.

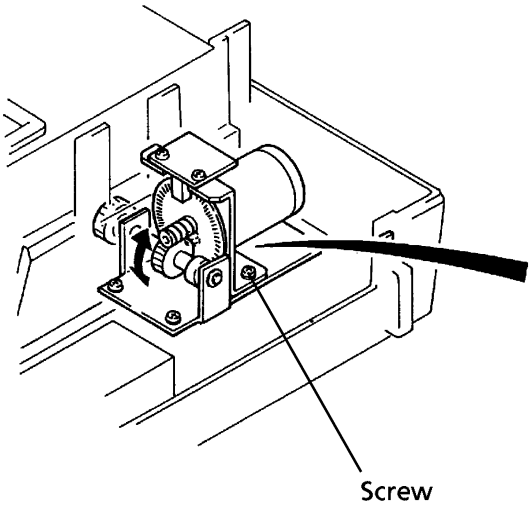
6. Reattach the operation panel cover as described in step 1 of the "Operation Panel Cover" subsection.

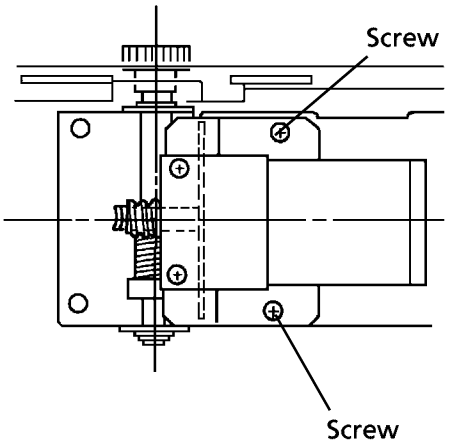
7. Reattach the magazine to the instrument.

6-16 Motor ASSY

Removal

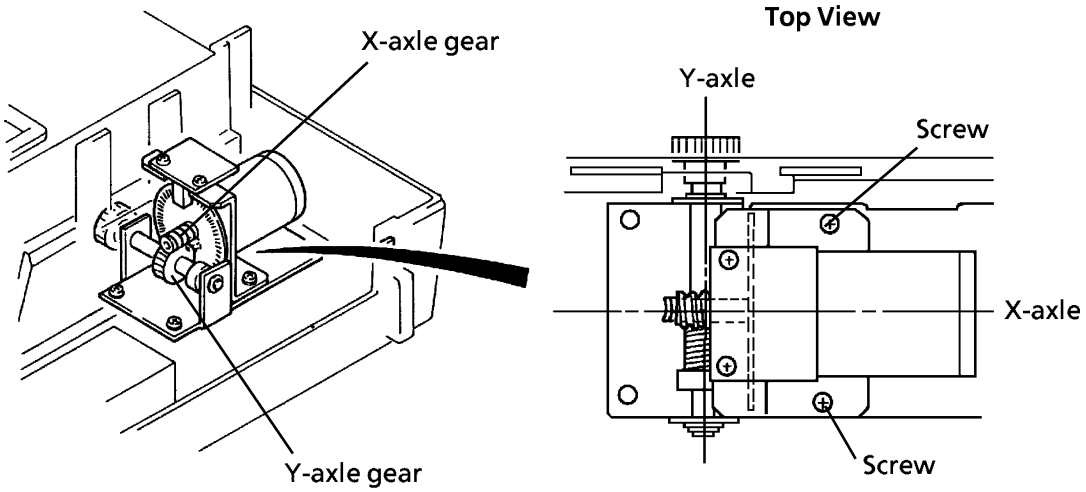
1. Read the precautions at the beginning of this section.
2. Detach the top casing from the bottom casing as described in the "Top Casing" subsection.
3. Remove the two screws which attach the motor ASSY to the top casing.





Replacement

1. When placing the motor ASSY into the top casing, place the X-axle gear of the motor ASSY above the Y-axle (platen roller ASSY) gear so that the axles are at right angles to each other.



2. Reattach the motor ASSY with the two screws.

3. Check the gear positions. The position of the motor ASSY affects the rotation of the X-axle gear and Y-axle gear. If these two gears are too close or too far apart, the rotation of one X-axle gear may not drive the rotation of the Y-axle gear. To adjust the gear position, loosen the two screws which attach the motor to the top casing, adjust the position of the motor ASSY, then tighten the two screws.

4. Repeat step 3 until the X-axle gear can drive the Y-axle gear.

5. Reattach the top casing to the bottom casing as described in the "Top Casing" subsection.

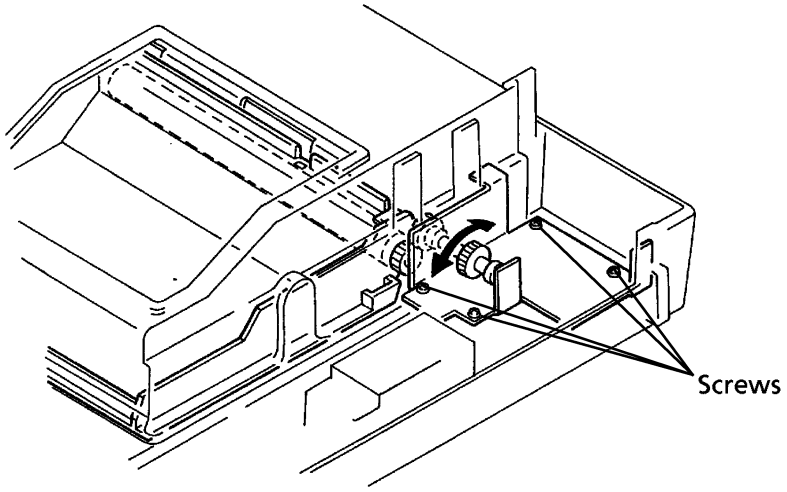
6-17 Motor-gear Base ASSY

Removal

1. Read the precautions at the beginning of this section.

2. Detach the top casing from the bottom casing, and the motor ASSY from the top casing, as described in the "Top Casing" and "Motor ASSY" subsections.

3. Remove the four screws which attach the motor-gear base ASSY to the top casing.



Replacement

1. Reattach the motor-gear base ASSY with the four screws.

2. Check the gear positions. The position of the motor-gear base ASSY affects the rotation of the gear of the platen roller and the gear of the motor-gear base ASSY. If these two gears are too close or too far apart, the rotation of one gear may not drive the rotation of the other gear. To adjust the gear position, loosen the four screws which attach the motor-gear base ASSY to the top casing, adjust the position of the motor-gear base ASSY, then tighten the two screws again.

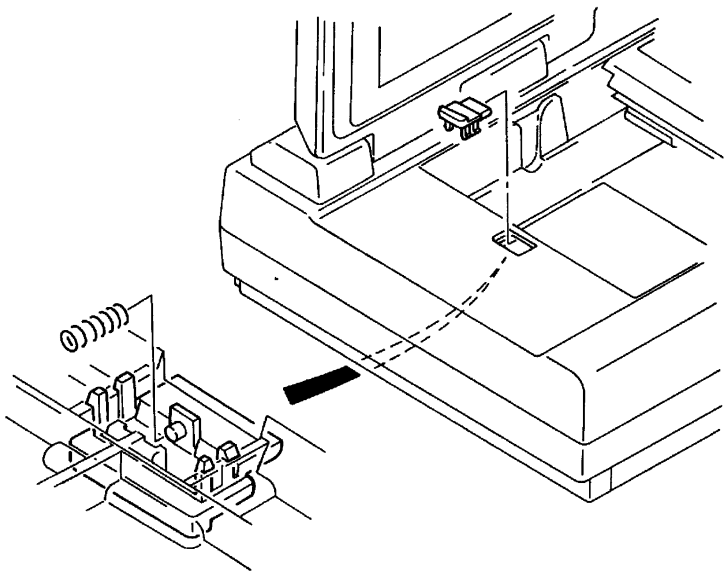
3. Repeat step 2 until the one gear can drive the other gear.

4. Reattach the motor ASSY to the top casing, and the top casing to the bottom casing as described in the "Motor ASSY" and "Top Casing" subsections.

6-18 Magazine Release Lever

Removal

1. Read the precautions at the beginning of this section.
2. Detach the top casing from the bottom casing as described in the "Top Casing" subsection.
3. Using a flat-blade screwdriver, depress the coil spring out of the spring rest of the magazine release lever.



4. Depress the four hooks of the magazine release lever inward to detach it from the top casing.

Replacement

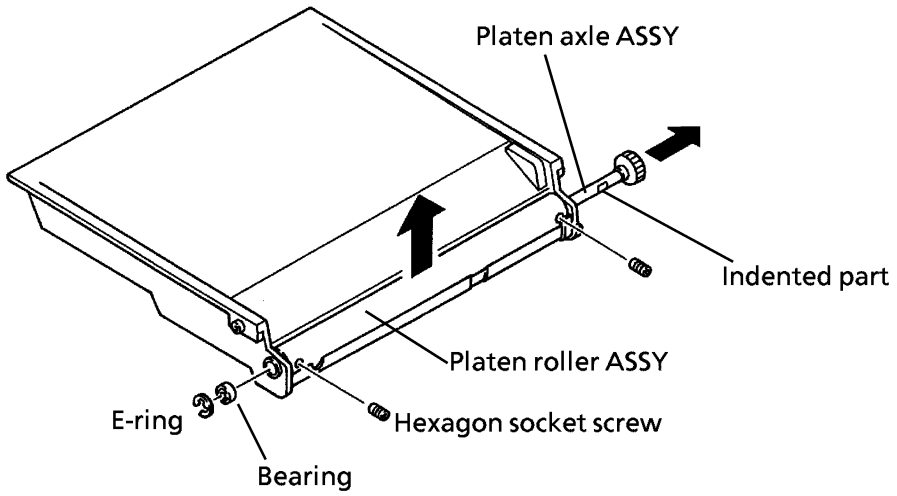
1. Reattach the magazine release lever to the top casing.
2. Hook the coil spring to the spring rest of the magazine release lever.
3. Reattach the top casing to the bottom casing as described in the "Top Casing" subsection.

6-19 Platen Roller ASSY

Removal

1. Slide the magazine release lever to detach the magazine from the instrument.

2. Using a hexagon key, remove the two hexagon socket screws which attach the platen roller ASSY to the platen axle ASSY.



3. Pull out the E-ring retainer which attaches the platen roller ASSY and the platen axle ASSY to the magazine.

4. Pull out the platen axle ASSY from the platen roller ASSY. This action detaches the platen axle ASSY, platen roller ASSY and bearing from the magazine.

NOTE

The E-ring retainer and bearing are very small parts so be careful not to lose them during the removal and replacement of the component.

Replacement

1. Insert the platen axle ASSY into the platen roller ASSY and bearing.

2. Reattach the platen roller ASSY, bearing and platen axle ASSY to the magazine with the E-ring.

3. Rotate the platen axle ASSY until its two indented parts are aligned with the holes of the hexagon socket screws on the platen roller ASSY. These indented parts on the platen axle ASSY provide a stable footing for the hexagon socket screws.

4. Using a hexagon key, reattach the platen roller ASSY with the two hexagon socket screws.

5. Reattach the magazine to the instrument.

6. Check that the platen roller ASSY rotates smoothly. If it does not, loosen the two hexagon socket screws and readjust the position of the platen roller ASSY in the magazine.

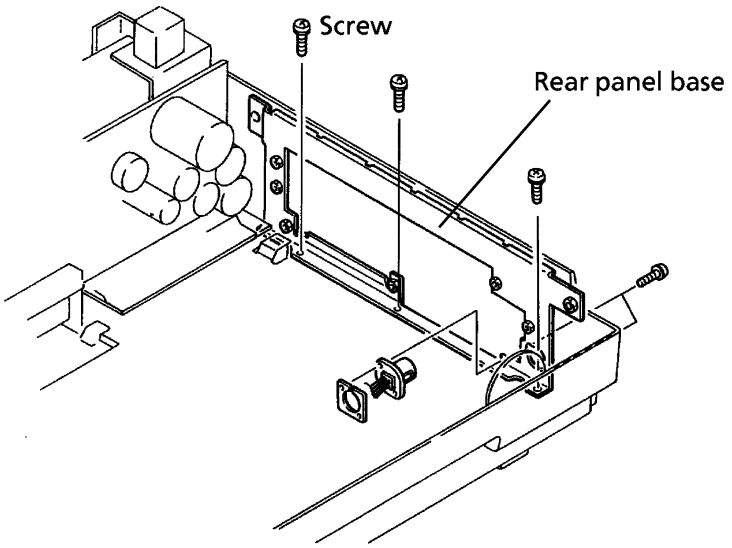
7. Repeat this step until the platen roller ASSY rotates smoothly.

6-20 Rear Panel Base

Removal

1. Read the precautions at the beginning of this section.

2. Detach the top casing from the bottom casing, and the CONTROL BD from the bottom casing, as described in the "Top Casing" and "CONTROL BD" subsections.



3. Remove the two screws which attach the a connector of the ECG input socket ASSY to the rear panel base.

4. Remove the three screws which attach the rear panel base to the bottom casing.

Replacement

1. Reattach the the rear panel base with the three screws.

2. Reattach the connector of the ECG input socket ASSY to the rear panel base with the two screws.

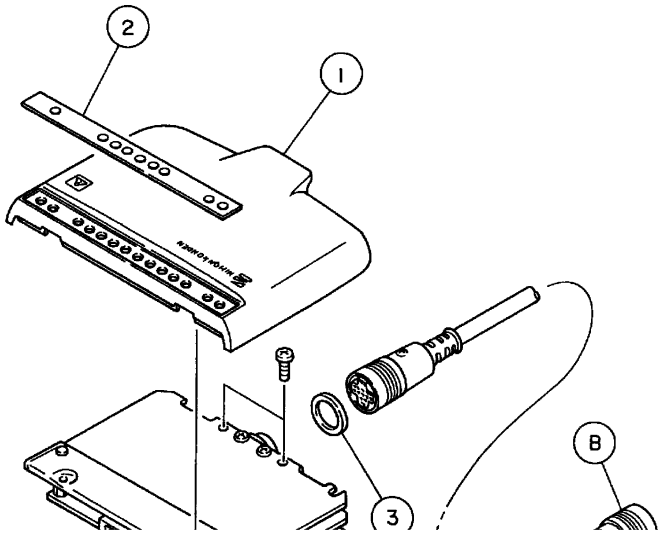
3. Reattach the CONTROL BD to the bottom casing, and the top casing to the bottom casing as described in the "CONTROL BD" and "Top Casing" subsections.

6-21 Input Box and Electrode Leads Cartridge

Assembly

1. Read the precautions at the beginning of this section.

2. Press the cartridge release button and pull the electrode leads cartridge away from the input box.



3. Remove the two screws which attach the box top casing to the box bottom casing.

4. Remove the two screws which attach the INPUT BOX BD to the bottom casing.

5. Remove the two screws which attach the cartridge top casing to the cartridge bottom casing.

Disassembly

1. Reattach the two screws to fasten the cartridge top casing to the cartridge bottom casing.

2. Reattach the INPUT BOX BD to the box bottom casing with the two screws.

3. Reattach the box top casing to the box bottom casing with the two screws.

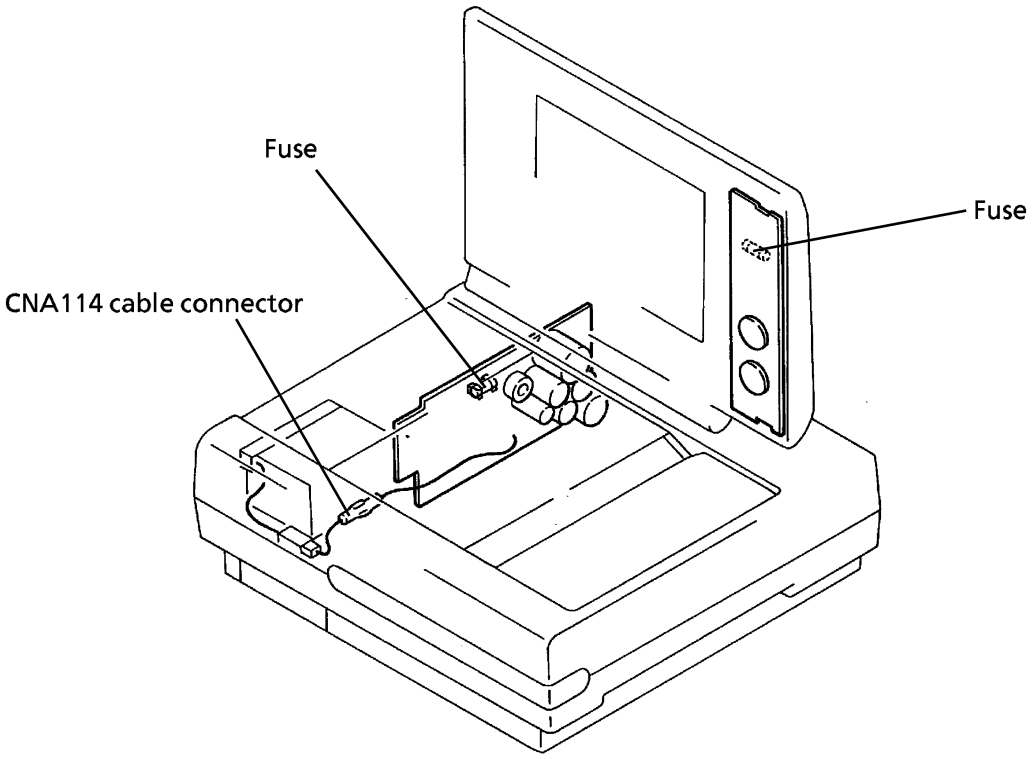
4. Reattach the electrode leads cartridge to the input box.

6-22 Fuse

NOTE

A blown fuse indicates that there may be a faulty circuit in the instrument. Always check the instrument for the cause of the blown fuse before replacing the fuse.

The illustration on the left shows the location of the four fuses in the instrument. Three fuses are located in the inside the instrument and one fuse is located at the rear panel of the instrument.



Fuse Location	Fuse Description	Fuse rating	NK Part No.
Rear Panel	218001	1 A (220 V to 240 V for ECG-9320G/K)	274026
	239002	2A (UL/CSA for ECG-9320A)	338864
Battery	314015	15 A	375915
POWER BD	218.800	0.8 A	370118
LCD KEY BD	218002	2 A	322893

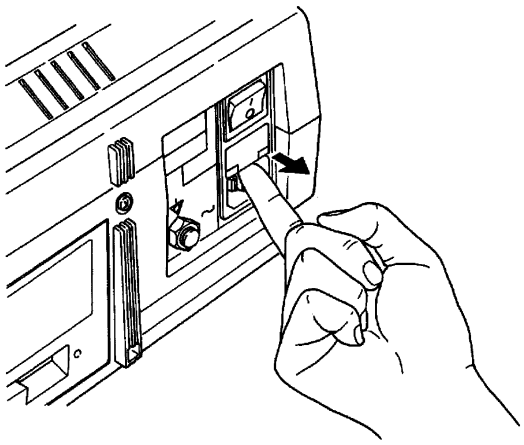
6-22-1 AC Main Fuse

Removal

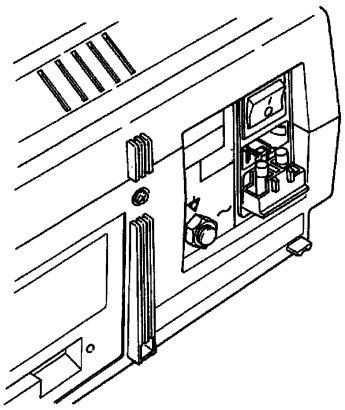
1. Make sure the instrument is off.

2. Unplug the power cord and disconnect all cables and electrode leads connected to the instrument.

3. Using tweezers, pry loose the fuse cover shown in the illustration below.



4. Swing open the fuse cover as shown in the illustration below.



5. Pull out the two fuses from the fuse holder.

Replacement

1. Replace the two fuses in the fuse holder.

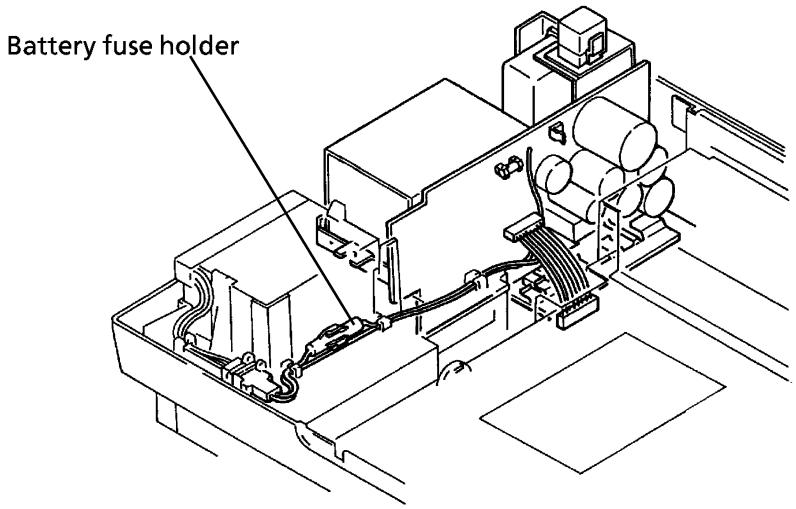
2. Close the fuse cover until the cover is level with the outer surface.

3. Connect in the power cord and all necessary cables or electrode leads to the instrument.

6-22-2 Battery Fuse

Removal

1. Read the precautions at the beginning of this section.
2. Detach the top casing from the bottom casing as described in the "Top Casing" subsection.
3. Detach the fuse holder from its rest at the side of the battery.



4. Twist the fuse holder to unlock the fuse holder.

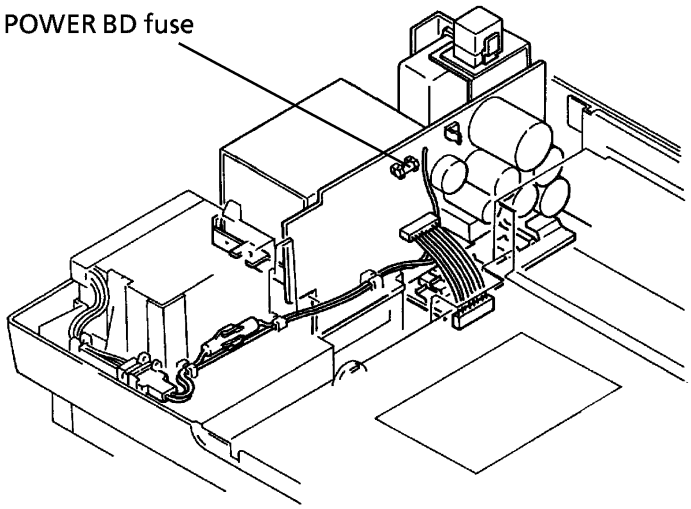
Replacement

1. Replace the fuse in the fuse holder.
2. Lock the fuse holder by twisting it.
3. Reattach the fuse holder to its rest at the side of the battery.
4. Reattach the top casing to the bottom casing as described in the "Top Casing" subsection.

6-22-3 POWER BD Fuse

Removal

1. Read the precautions at the beginning of this section.
2. Detach the top casing from the bottom casing as described in the "Top Casing" subsection.
3. Remove the fuse from its holder on the POWER BD.



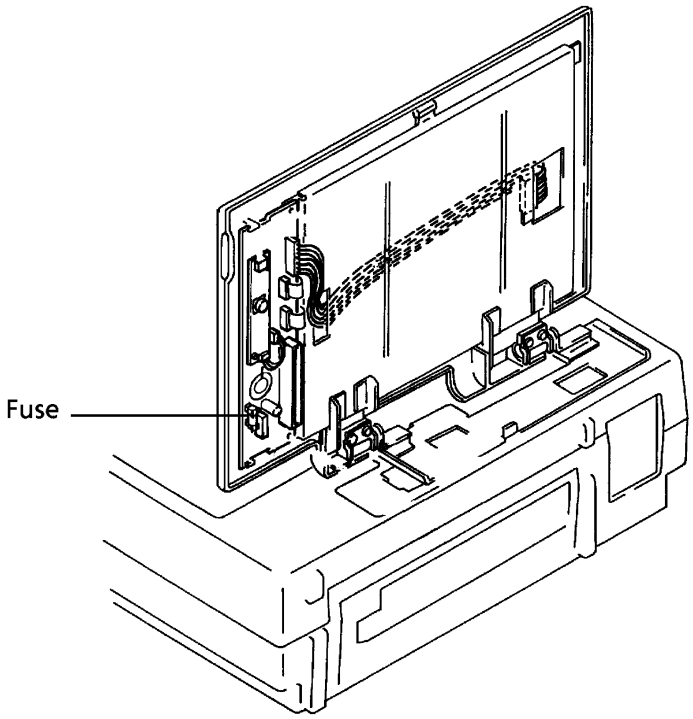
Replacement

1. Replace the fuse in its holder on the POWER BD.
2. Reattach the top casing to the bottom casing as described in the "Top Casing" subsection.

6-22-4 LCD KEY BD Fuse

Removal

1. Read the precautions at the beginning of this section.
2. Detach the LCD panel rear cover as described in the "LCD Panel Rear Cover" subsection.
3. Remove the fuse from its holder on the LCD KEY BD.



Replacement

1. Replace the fuse in its holder on the LCD KEY BD.
2. Reattach the LCD panel rear cover as described in the "LCD Panel Rear Cover" subsection.

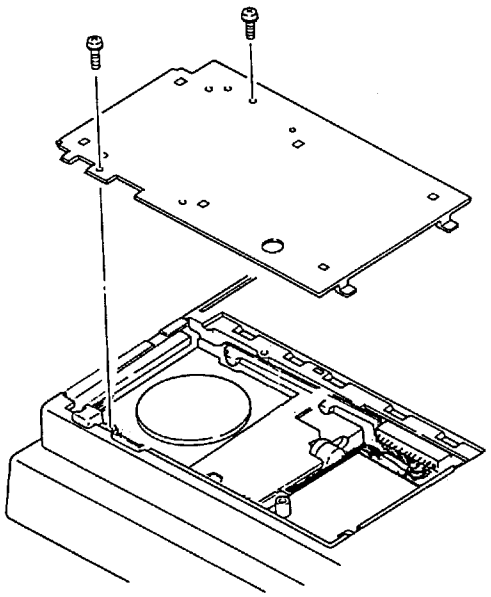
6-23 Floppy Disk Unit

NOTE

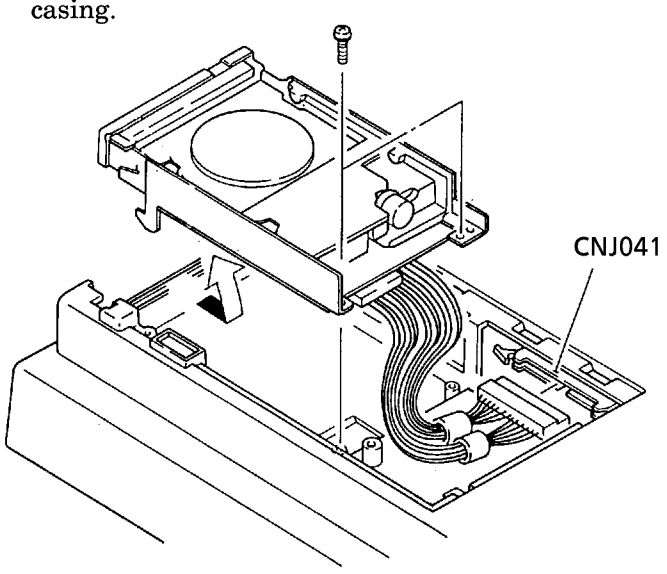
The illustrations of the floppy disk unit shown here may be different from that of the actual unit. Although the model of the floppy disk unit may change, the procedures described here will still be applicable.

Removal

1. Read the precautions at the beginning of this section.
2. Remove the two screws which attach the FD cover ASSY to the bottom casing.



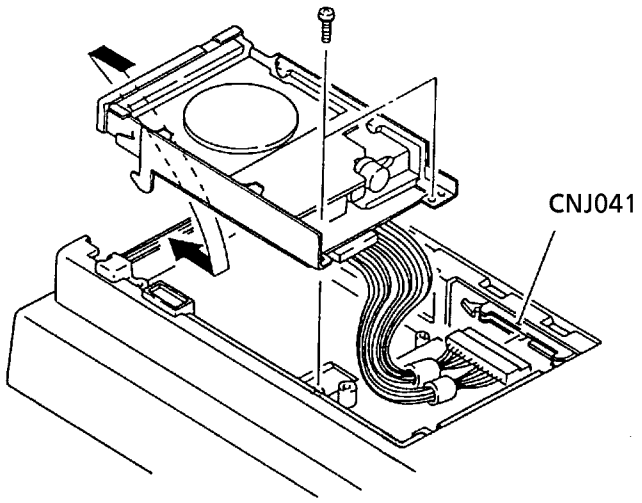
3. Remove the two M3×8 screws which attach the floppy disk unit to the bottom casing.



4. Disconnect the floppy disk unit cable from the CNJ041 connector on the CONTROL BD.
5. Slightly push the floppy disk unit inward and lift it off the bottom casing.

Replacement

1. Replace the floppy disk unit into the bottom casing.

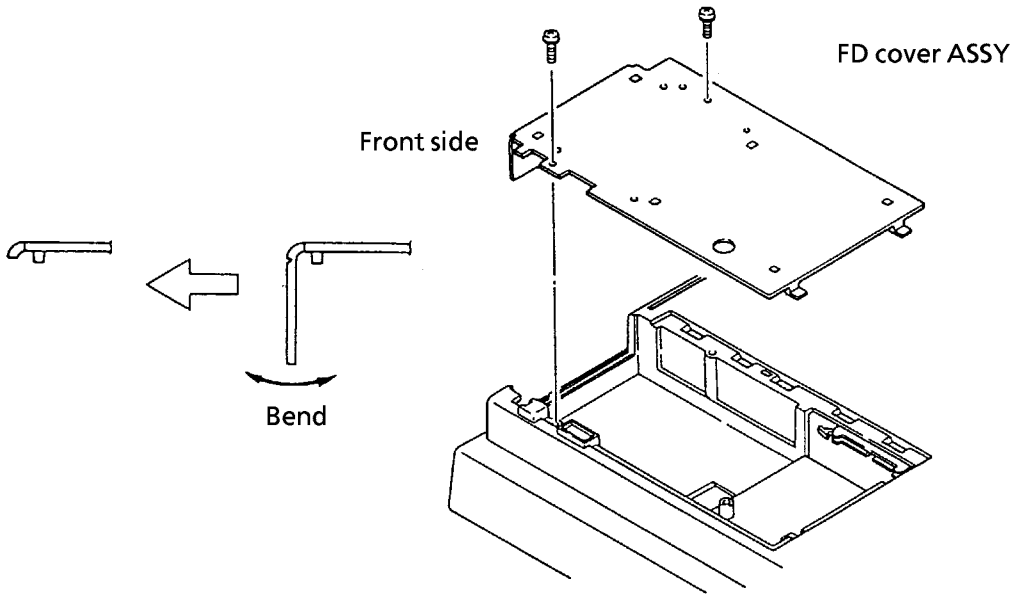


2. Reconnect the floppy disk unit cable to the CNJ041 connector on the CONTROL BD.
3. Reattach the floppy disk unit with the two M3×8 screws.
4. Reattach the FD cover ASSY with the two screws.

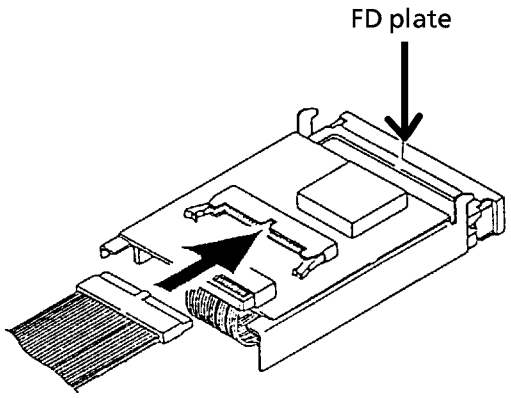
New Installment

1. Read the precautions at the beginning of this section.
2. Remove the two screws which attach the FD cover ASSY to the bottom casing.

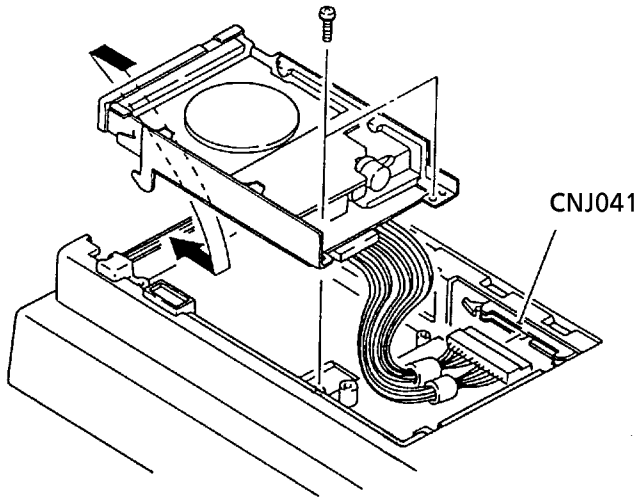
3. Bend the floppy disk slot cover of the FD cover ASSY as shown in the illustration below to break and remove the cover from the FD cover ASSY.



4. Use a double-sided cellophane tape to stick the FD plate to the floppy disk unit.



5. Put the floppy disk unit in the bottom casing.



6. Connect the floppy disk unit cable to the CNJ041 connector on the CONTROL BD.

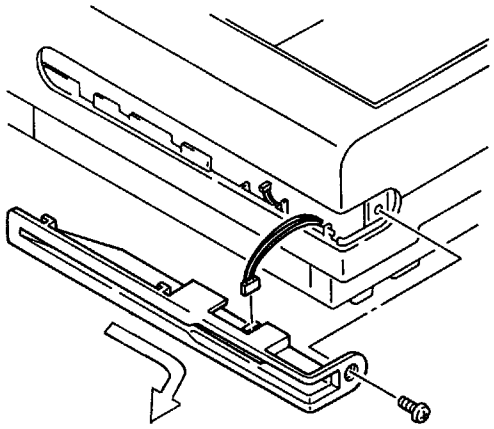
7. Use the provided two M3×8 screws to attach the floppy disk unit to the bottom casing.

8. Reattach the FD cover ASSY with the two screws.

6-24 Magnetic Card Reader

Removal

1. Read the precautions at the beginning of this section.
2. Remove the screw which attaches the card reader guide cover to the bottom casing.



3. Slightly pull the card reader guide cover out to expose the CNA106 cable.
4. Disconnect the CNA106 cable from the magnetic card reader.
5. Remove the four screws which attach the magnetic card reader to the card reader guide cover.

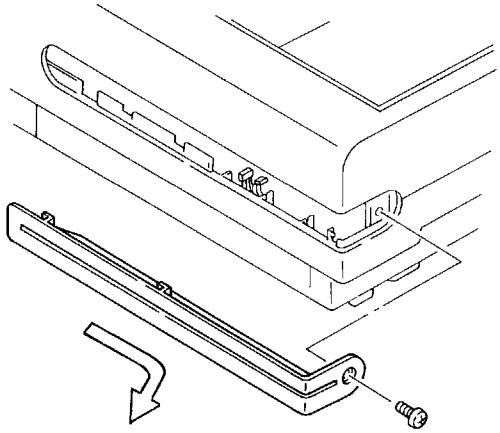
Replacement

1. Reconnect the CNA106 cable to the magnetic card reader.
2. Reattach the card reader guide cover to the bottom casing.

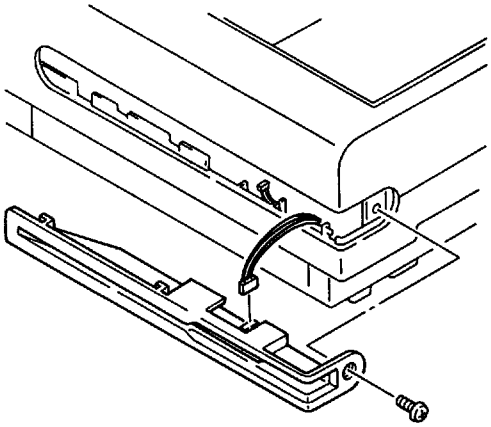
New Installment

1. Read the precautions at the beginning of this section.

2. Remove the screw which attaches the card reader guide cover to the bottom casing.



3. Connect the CNA106 cable to the magnetic card reader.



4. Reattach the card reader guide cover to the bottom casing.

6-25 Extend Memory Module SIMM

A locally available 4MB memory module SIMM is used to extend the memory of the instrument. The specification of this memory module SIMM is:

Extend Memory (4MB) (CM)
72-pin SIMM module non parity 60 ns
(sold for Macintosh "Sentris 660AV", "Quadra 800" and "Quadra 840AV")

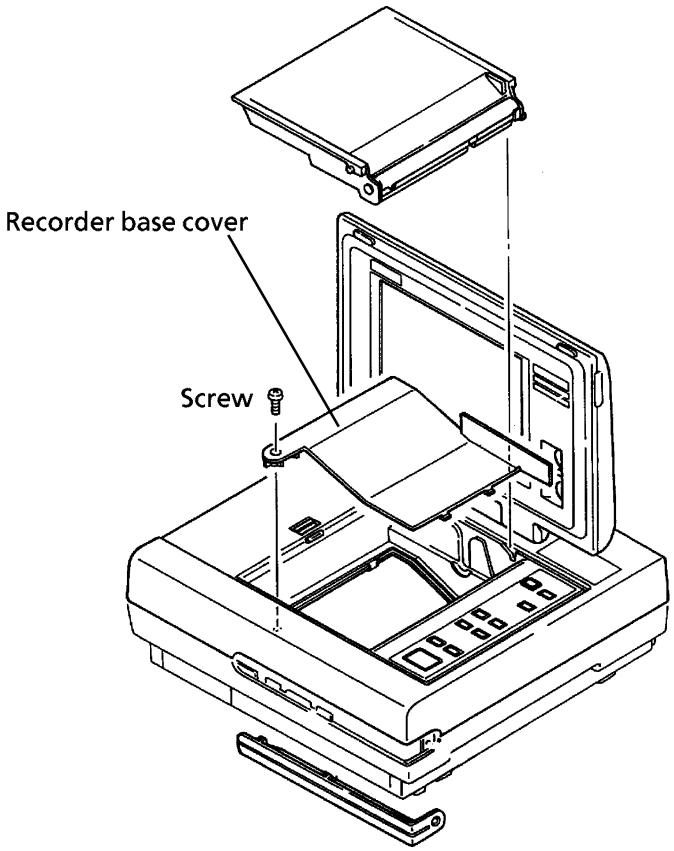
Installation

1. Read the precautions at the beginning of this section.

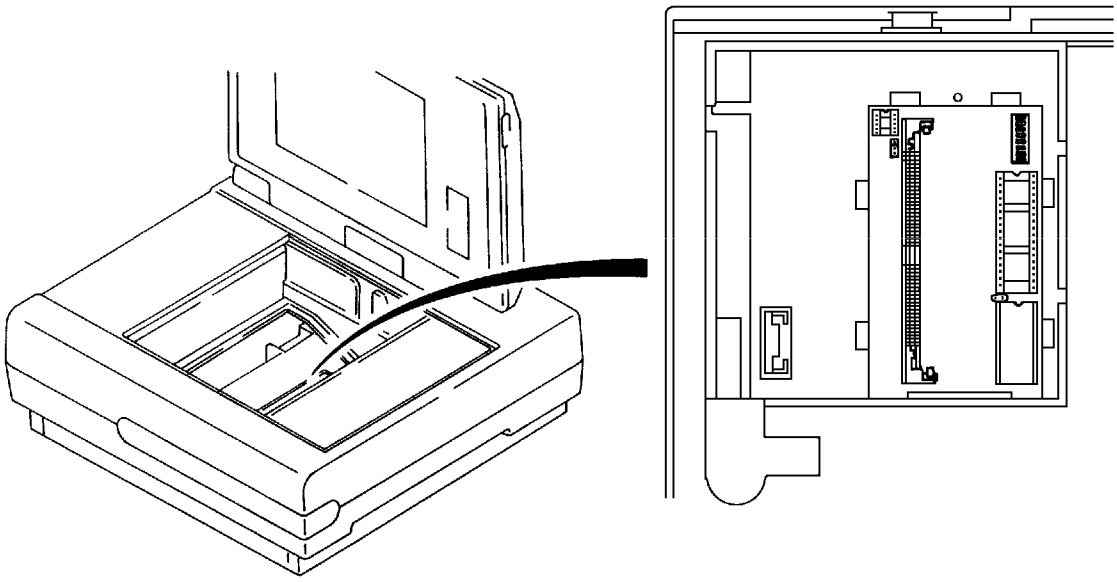
2. Slide the magazine release lever to detach the magazine from the instrument.

3. Remove the screw which attaches the recorder base cover to the chassis of the instrument.

4. Lift the recorder base off the chassis of the instrument.

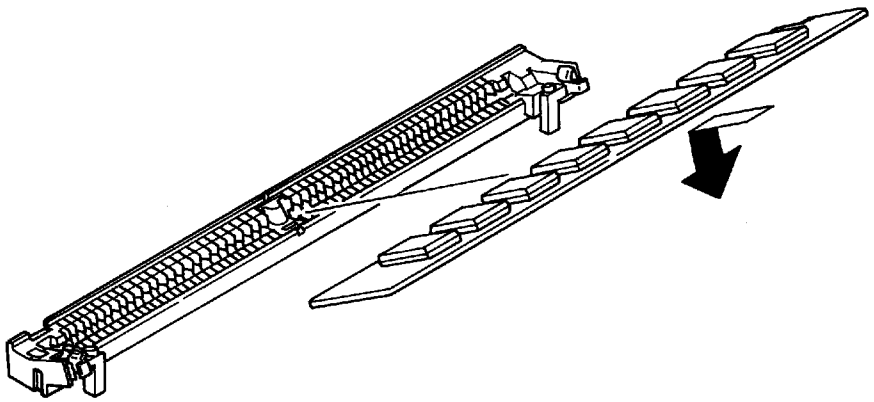


The memory SIMM socket is located on the CONTROL BD.



5. Holding the SIMM module only by the edges, remove it from its antistatic package.

6. Position the SIMM module at about 45 degree angle relative to the socket on the CONTROL BD. The small notch in the middle of the bottom edge of the SIMM mates with the raised bump in the SIMM socket.

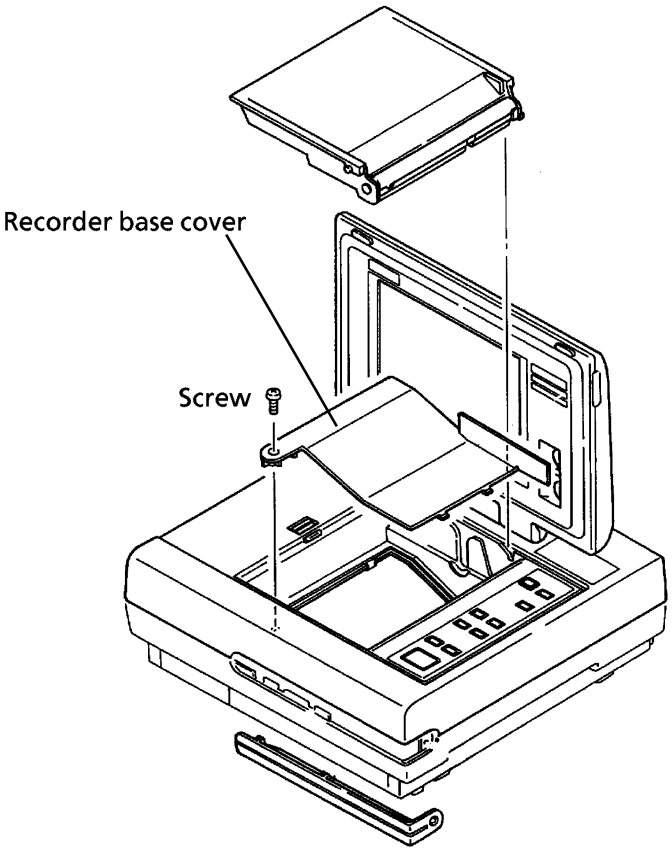


7. Insert the bottom edge of the SIMM into the socket and press in firmly on the SIMM until it seats correctly.

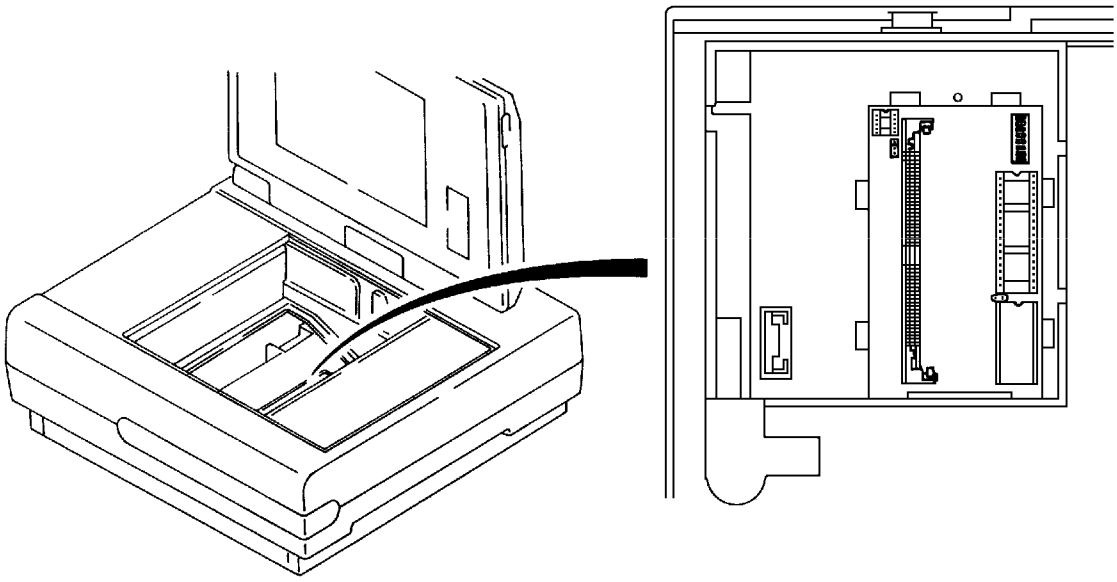
8. When the SIMM seats correctly, hold it at each end and gently push the top edge (downward) towards the retaining clips of the socket until the SIMM snaps into place. The small horizontal posts, next to the retaining clips, will pass through the holes in the ends of the SIMM.

Removal

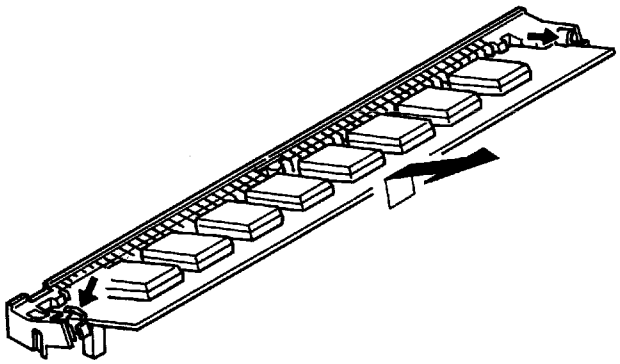
1. Read the precautions at the beginning of this section.
2. Slide the magazine release lever to detach the magazine from the instrument.
3. Remove the screw which attaches the recorder base cover to the chassis of the instrument.
4. Lift the recorder base off the chassis of the instrument.



The memory SIMM socket is located on the CONTROL BD.



5. Gently push the retaining clips in opposite directions just enough so that you can tilt the top edge of the SIMM away from the clips.



6. Carefully lift the SIMM away from the socket and store it in an antistatic package.

Section 7 INTERNAL SWITCH AND JUMPER SETTING

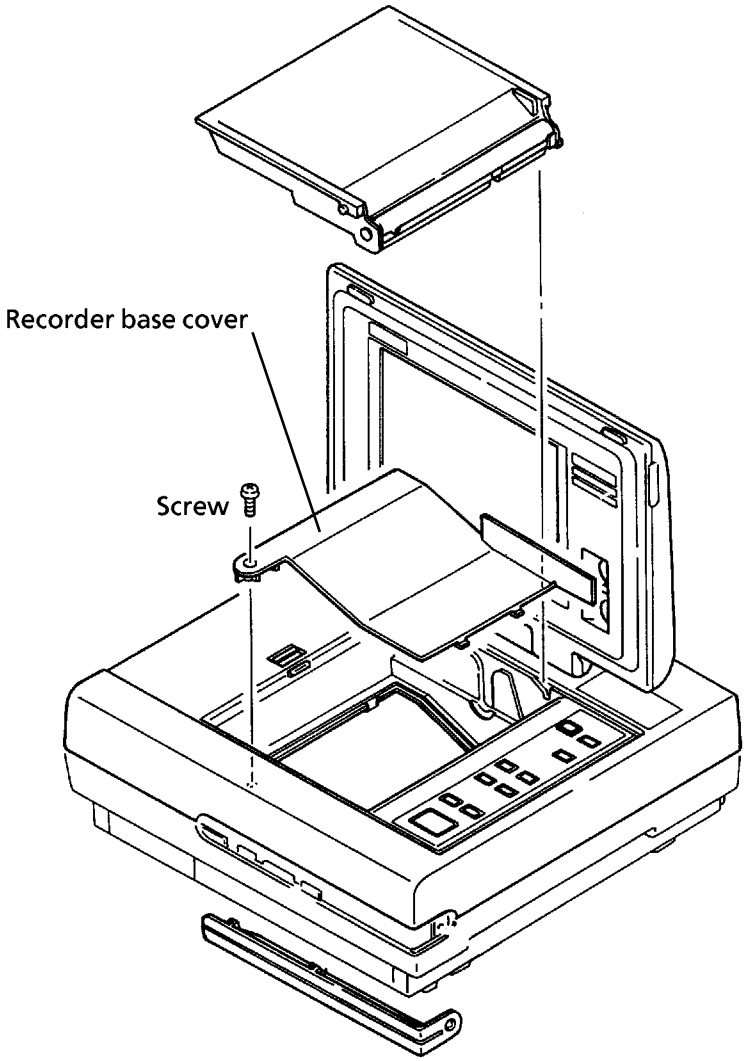
7-1 DIP Switch SW1701 ..... 7.1
7-1-1 Thermal Head Recording Resolution Setting (SW1) 7.2
7-1-2 Paper Width Setting (SW2) 7.2
7-1-3 Thermal Head Resistance Setting (SW5 to SW8) 7.3
7-2 Jumper Setting 7.4

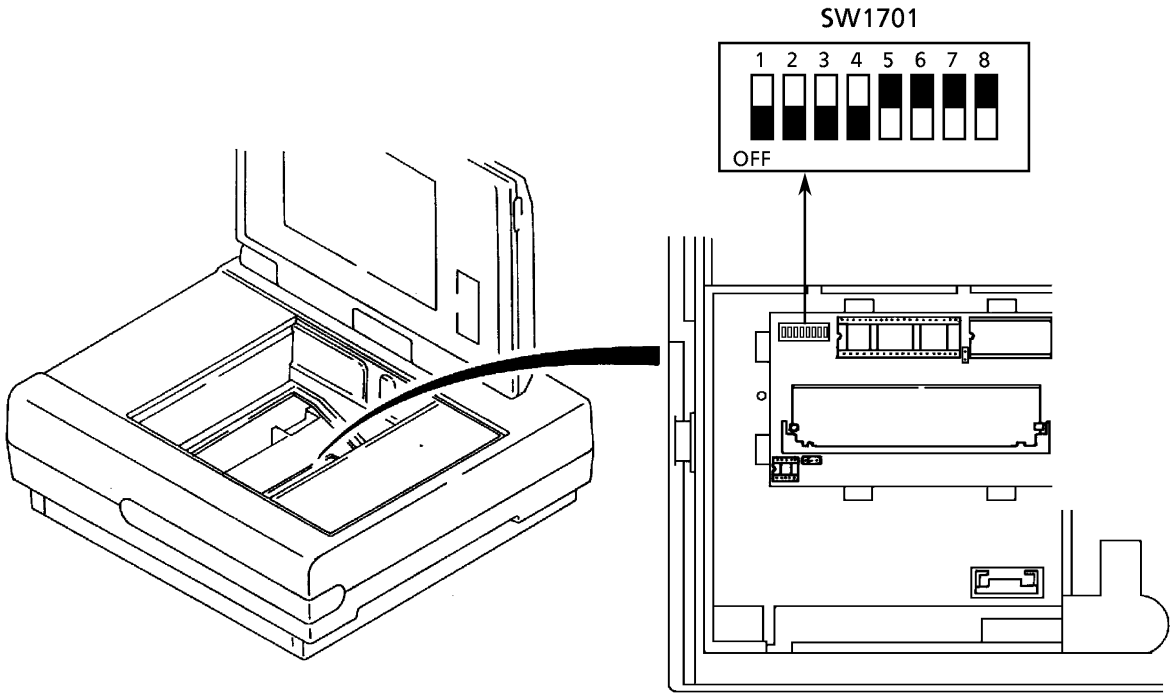
All internal switches are on the CONTROL BD.

7-1 DIP Switch SW1701

Procedure to Access DIP Switch SW1701

1. Press the magazine release button to detach the magazine from the instrument.
2. Remove the screw fastening the recorder base cover to the chassis of the instrument.
3. Lift the recorder base cover off the instrument to expose the DIP switch SW1701.





7-1-1 Thermal Head Recording Resolution Setting (SW1)

SW1 of DIP switch SW1701 sets the thermal head recording resolution.

OFF 8 dot/mm (Default setting)

7-1-2 Paper Width Setting (SW2)

The SW2 of DIP switch SW1701 sets the recording paper width.

OFF 210/216 mm (Default setting)

7-1-3 Thermal Head Resistance Setting (SW5 to SW8)

NOTE

The recording density of the thermal head depends on the thermal head resistance value. This value differs from one thermal head to another. Therefore, reset this thermal head resistance setting each time the thermal head is replaced. Failure to do this may cause the recording to be too faint or too dark. Refer to the "Thermal Head" subsection in Section 6 for the replacement procedure of the thermal head.

SW5, SW6, SW7, and SW8 set the thermal head resistance. The positions of the four switches correspond to the thermal head resistance at 8 dot/mm recording resolution. The table below shows the position of the four switches and the thermal head resistance at the two recording resolution.

SW5	SW6	SW7	SW8	Thermal Head Resistance and Resolution
ON	ON	ON	ON	NA
ON	ON	ON	OFF	NA
ON	ON	OFF	ON	NA
ON	ON	OFF	OFF	1173 to 1230
ON	OFF	ON	ON	1231 to 1281
ON	OFF	ON	OFF	1282 to 1333
ON	OFF	OFF	ON	1334 to 1385
ON	OFF	OFF	OFF	1386 to 1437
OFF	ON	ON	ON	1438 to 1489
OFF	ON	ON	OFF	1490 to 1541
OFF	ON	OFF	ON	1542 to 1587

NA = Not available

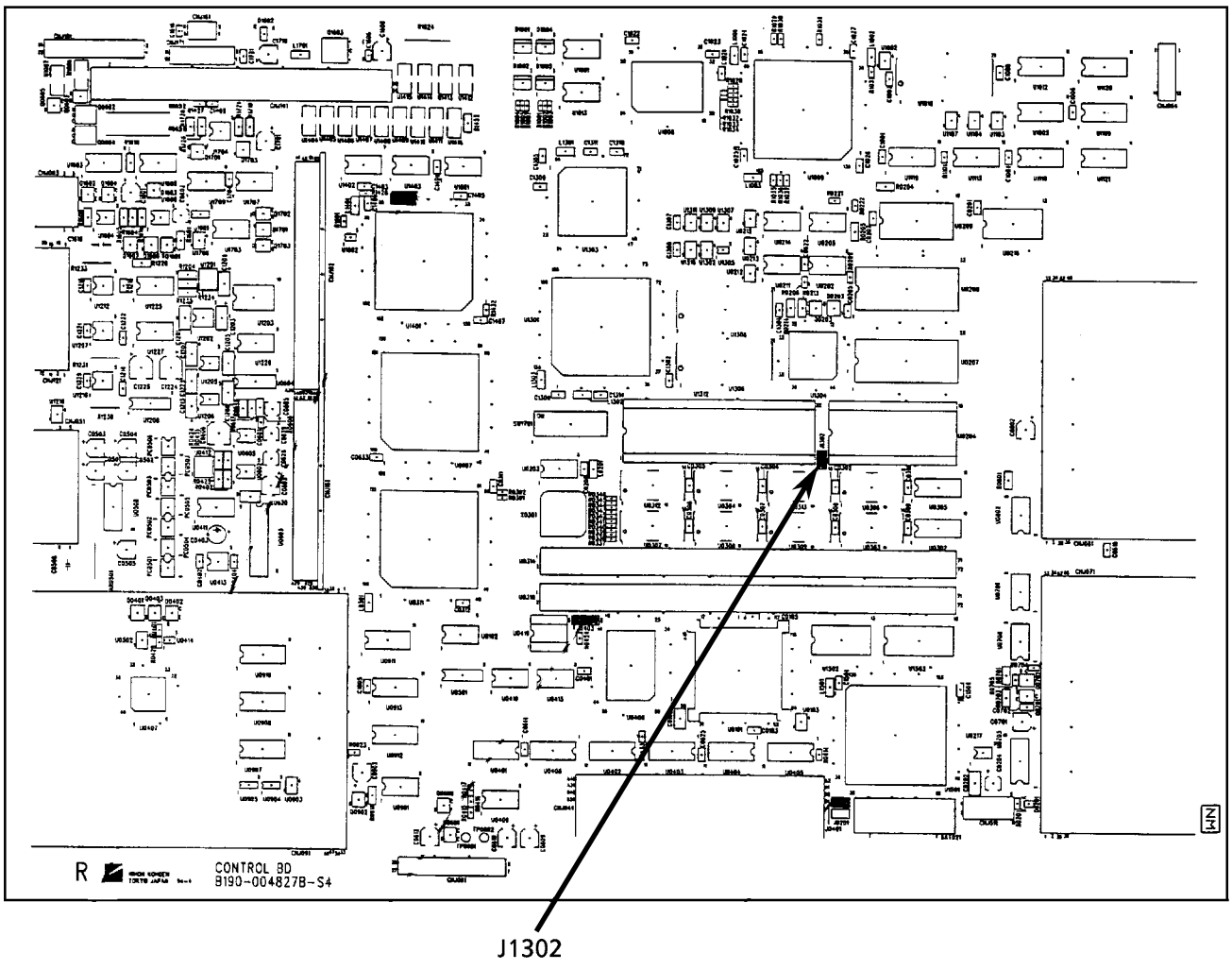
7-2 Jumper Setting

Procedure to Expose the CONTROL BD

Refer to steps 1 through 12 of the "CONTROL BD" subsection in Section 6 to expose the CONTROL BD.

There are four short-circuiting jumpers in the CONTROL BD. The settings of these jumpers are listed below.

J1302 Pin-1 and pin-2 are shorted



Section 8 ADJUSTMENT

8-1 Adjusting Thermal Head Position 8.1
8-2 Changing the Sensitivity of the External Input/Output 8.4
8-2-1 Changing the Sensitivity of the External Input 8.4
8-2-2 Changing the Sensitivity of the External Output 8.5
8-2-3 Resistor Location 8.6
8-3 Changing Magazine Paper Width 8.7

Required Tools:
Digital voltmeter
Flat-blade screwdriver (insulated type)
Phillips screwdriver (insulated type)
Nipper

8-1 Adjusting Thermal Head Position

Adjust the thermal head position when the printing is not even, some character or part of a graphic is not printed, or skewing occurs. This adjustment has two parts; the first part adjusts the height of the thermal head, and the second part adjusts the alignment of the printing edge perpendicular to the direction of printing.

When the height of the thermal head over the recording paper is not the same over the entire length of the printing head, printing density differs along the length of the thermal head. A thermal dot that is nearer to the recording paper gives a denser printing than one that is further away. If the thermal dot is too far from the recording paper, no printing can occur on the recording paper below this thermal dot.

When the printing edge of the thermal head is not perpendicular to the direction of printing, skewing occurs because some part along perpendicular width of the recording paper is printed earlier than the other part. This distorts the printed information to one side of the recording paper.

Preparation

1. Remove the operation panel cover as described in the "Disassembly and Assembly" section.

2. Do not remove the CNA102 cable from the Key Board Unit.

3. Reattach the magazine with the recording paper set.

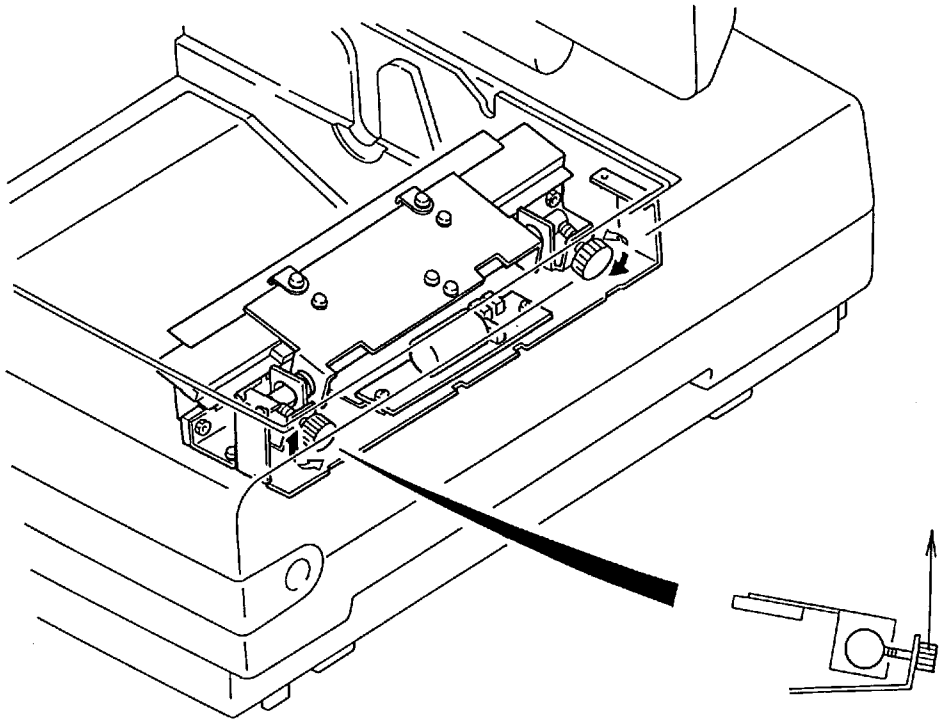
4. If the instrument is off, switch on the instrument and call up the SYSTEM TEST screen.

Printing Evenness Check and Correction Procedure

1. In the System Test menu screen, press the Recorder key to start the test. The recorder prints recording test patterns.

2. Check the printed recording test patterns for evenness of recording and no loss of recording information.

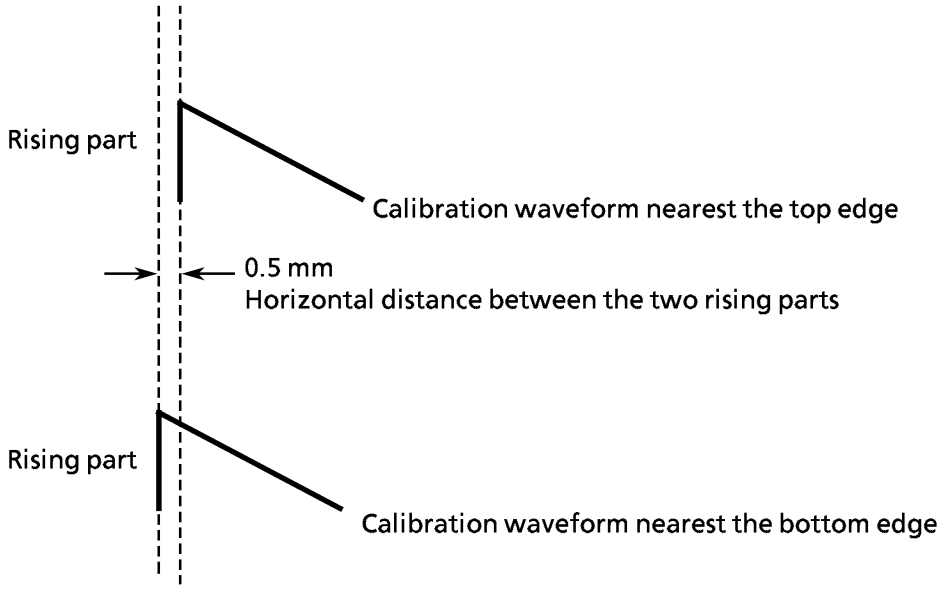
3. If the printed recording test patterns are not even or some information is not printed, adjust the adjustment knobs shown in the illustration below.



Skew Check and Correction Procedure

1. In the normal operation mode, print the calibration waveforms.

2. To check whether the printing has skewed or not, look at the calibration waveform nearest the top of the recording paper and the calibration waveform nearest the bottom of the recording paper. The printing is considered skewed if the horizontal distance between the two rising parts of these two calibration waveforms is more than 0.5 mm.


Rising part
Calibration waveform nearest the top edge
0.5 mm
Horizontal distance between the two rising parts
Rising part
Calibration waveform nearest the bottom edge

3. To correct the skew, adjust the two adjustment knobs until the length of the thermal head is perpendicular to the direction of printing. Turning the knob one full revolution clockwise moves one end of the thermal head 0.5 mm towards the magazine. Turning the knob one full revolution counterclockwise moves one end of the thermal head 0.5 mm away from the magazine.

4. Repeat the printing evenness check and correction procedure and skew check and correction procedure until the recording is evenly printed with no loss of recording information and no skewing.

8-2 Changing the Sensitivity of the External Input/Output

Change the sensitivity of the external input and output of the instrument to connect a peripheral device that has a different sensitivity output or input.

NOTE

Changing the sensitivity of the EXT IN1 and EXT IN2 external input or CRO1 output causes the instrument to give a "Malfunction" message in the sensitivity test item in the input box test of the System Test window menu. This is because the system test software of the instrument does not accept the changed sensitivity of the external input or output.

8-2-1 Changing the Sensitivity of the External Input

Use this procedure to change the sensitivity of an external input by adding a locally available resistor to the printed circuit board.

The table below shows the resistor circuit number of each external input of the CONTROL BD and EXTENSION I/O BD. The position of the resistor is shown in the "Resistor Location" subsection.

Board Name	External Input Name	Resistor Circuit No.
CONTROL BD	EXT IN1	RX122
CONTROL BD	EXT IN2	RX124
EXTENSION I/O BD	EXT IN3	RXI03
EXTENSION I/O BD	EXT IN4	RXI04
EXTENSION I/O BD	EXT IN5	RXI05
EXTENSION I/O BD	EXT IN6	RXI06

To Calculate the Resistance of the Additional Resistor

Use the formula below to calculate R, the resistance of the additional resistor, for a desired sensitivity amplification of an external input.

$$\text{Desired sensitivity amplification} = 1 + (10\,\text{k}\Omega \div \text{R})$$

Example

If the desired sensitivity amplification is 2× (from 2 cm/V to 4 cm/V):

$2 = 1 + (10\,\text{k}\Omega \div \text{R})$

$\text{R} = 10\,\text{k}\Omega$

8-2-2 Changing the Sensitivity of the External Output

Use this procedure to change the sensitivity of an external output by adding a locally available resistor to the printed circuit board.

The table below shows the resistor circuit number of each external output of the CONTROL BD and EXTENSION I/O BD. The position of the resistor is shown in the "Resistor Location" subsection.

Board Name	External Output Name	Resistor Circuit No.
CONTROL BD	CRO1	RX121
EXTENSION I/O BD	CRO1	RXO01, RXO11
EXTENSION I/O BD	CRO2	RXO02
EXTENSION I/O BD	CRO3	RXO03
EXTENSION I/O BD	CRO4	RXO04
EXTENSION I/O BD	CRO5	RXO05
EXTENSION I/O BD	CRO6	RXO06

To Calculate the Resistance of the Additional Resistor

Use the formula below to calculate R, the resistance of the additional resistor, for a desired sensitivity amplification of an external output. For the CRO1 external output of the EXTENSION I/O BD, use the formula after the Example.

Desired sensitivity amplification $= 1 + (10\ \text{k}\Omega \div \text{R})$

Example

If the desired sensitivity amplification is 2× (from 2 cm/V to 4 cm/V):

$2 = 1 + (10\ \text{k}\Omega \div \text{R})$

$\text{R} = 10\ \text{k}\Omega$

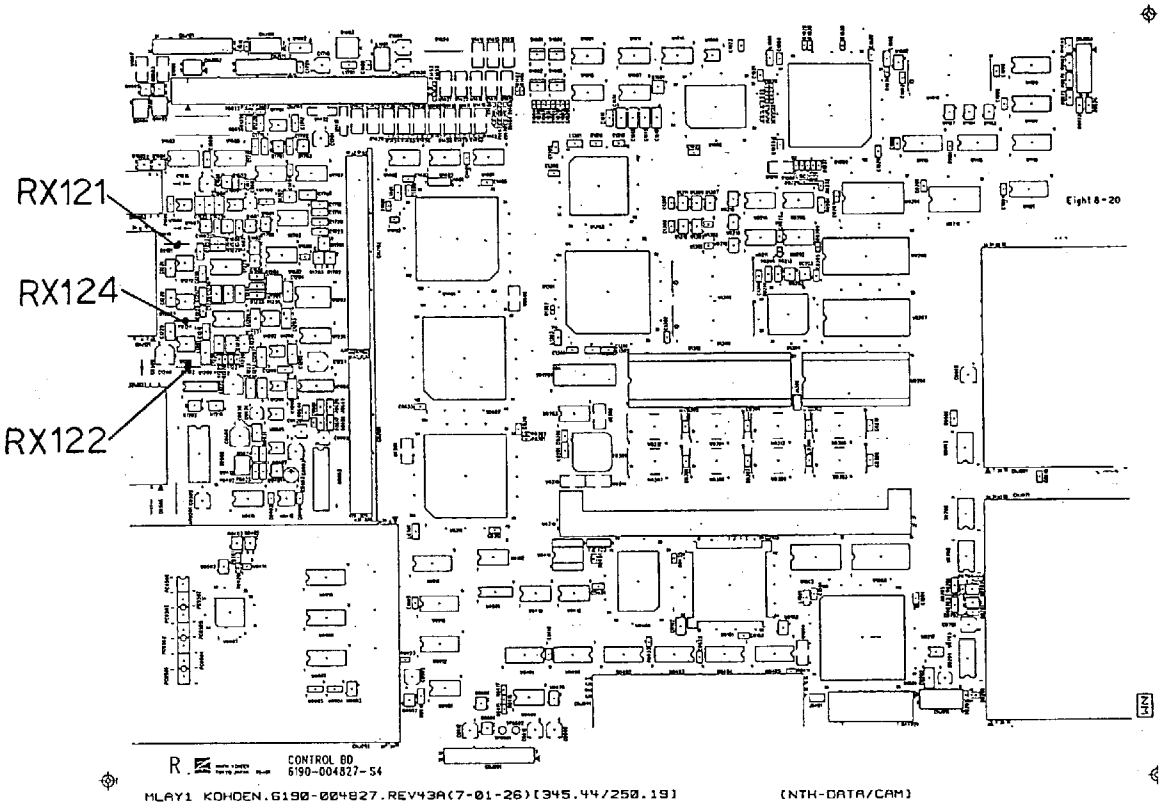
For CRO1 external output of the EXTENSION I/O BD,

Desired sensitivity amplification

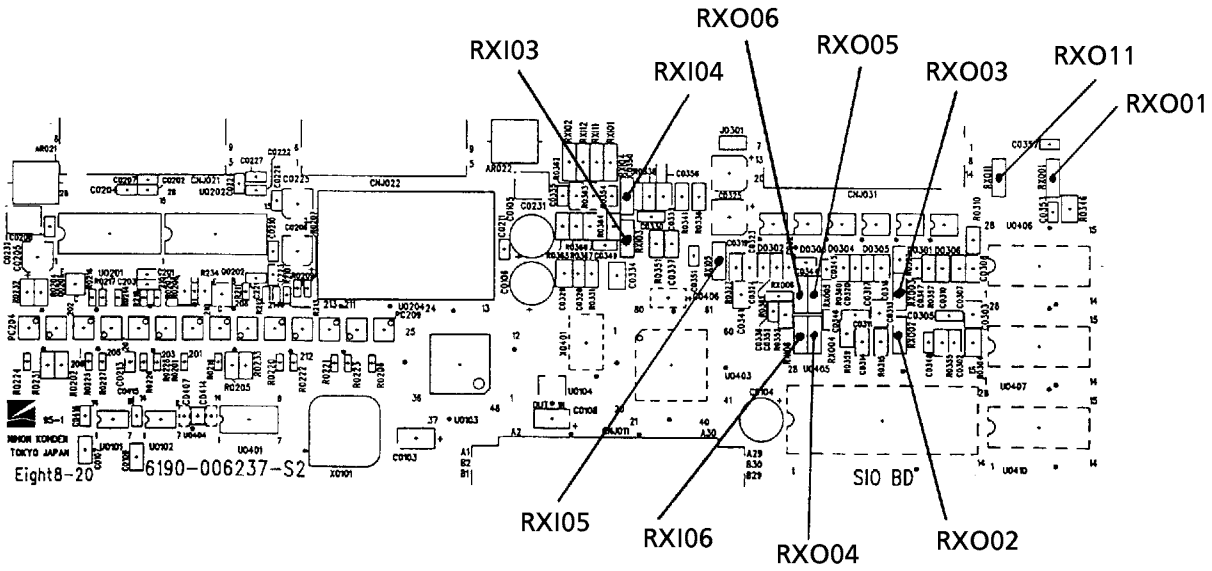
$= 1 + (10\ \text{k}\Omega \div \text{RX001}) \times \{\text{RX011} \div (10\ \text{k}\Omega \div \text{RX011})\}$

8-2-3 Resistor Location

CONTROL BD



EXTENSION BD



8-3 Changing Magazine Paper Width

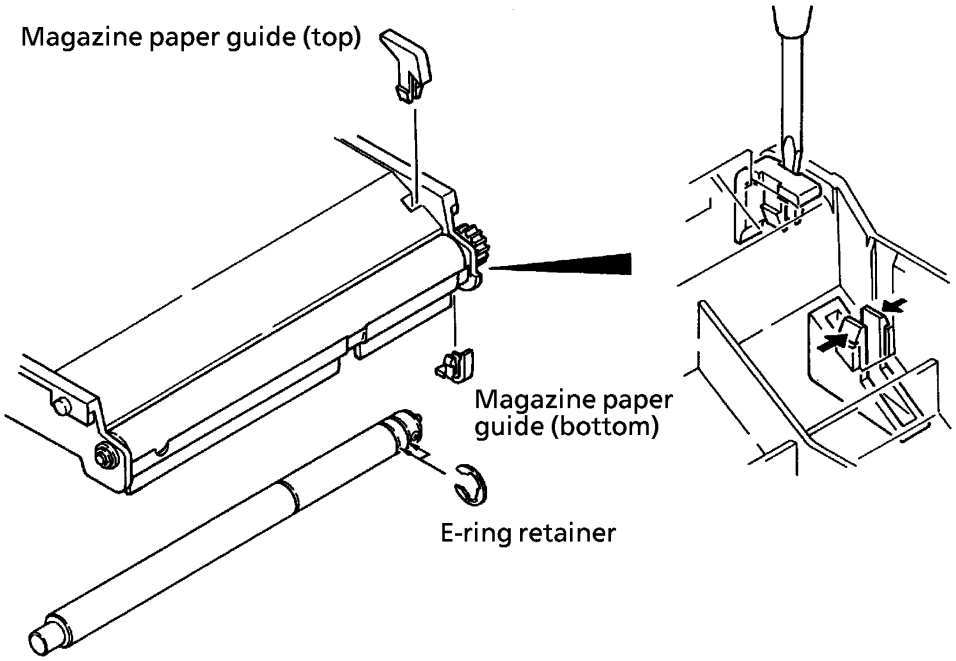
The paper width of the magazine can be changed from 210 mm to 216 mm. This allows the use of 216 mm width recording paper, however, the printing width of the recorder remains the same.

NOTE

The paper width of the magazine can be changed back to 210 mm, however, the recorder base cover must be replaced with a new one because the cut part cannot be reattached.

Changing Procedure

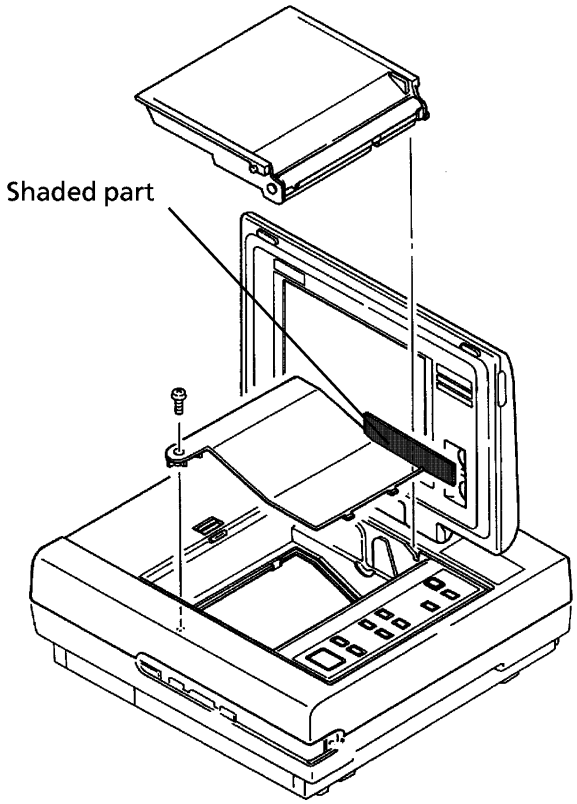
1. Use a flat-blade screwdriver to pry out the magazine paper guide (bottom).



2. Press the two tabs of the magazine paper guide (top) inward to remove it from the magazine.

3. Move the E-ring retainer from the inner position to the outer position of the platen roller ASSY.

4. Use a nipper to cut off the side (the shaded part of the illustration shown below) of the recorder base cover.



Section 9 REPLACEABLE PARTS LIST

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9-3-17 YZ-026D5 Paper Axle ASSY 9.35
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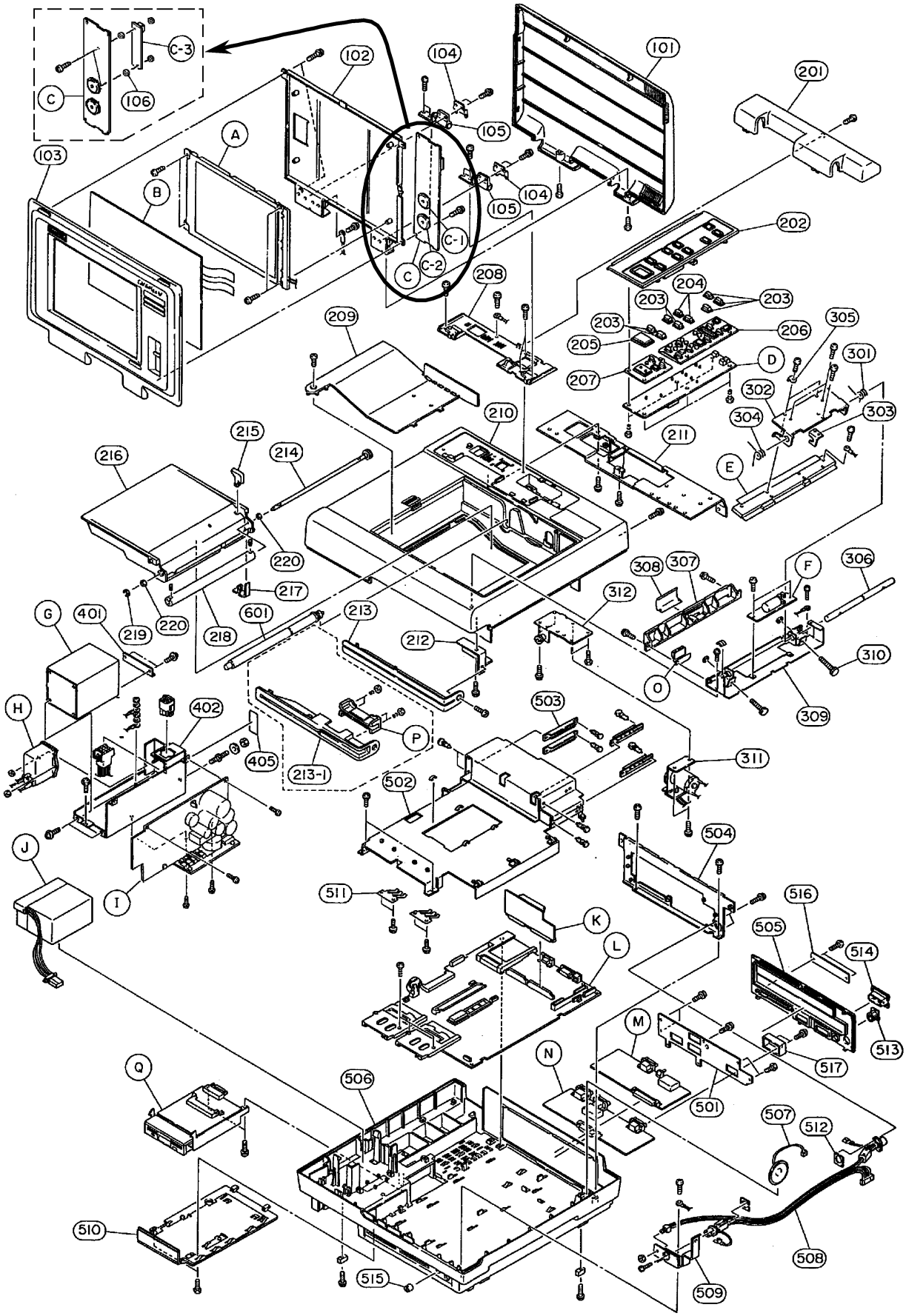
9-1 Main Unit

Index	NK Parts No.	QTY	Description	
101	6111-004013	1	LCD panel rear cover 721	LCD後パネル721
102	6111-003754A	1	LCD base plate (9350)	LCD基板(9350)
103	YZ-006H3	1	9320A LCD panel front ASSY	9320A用LCD前パネルASSY
	YZ-006H4	1	9320K LCD panel front ASSY	9320K用LCD前パネルASSY
	YZ-006H5	1	9320G LCD panel front ASSY	9320G用LCD前パネルASSY
104	6114-034349	2	Hinge ASSY bracket	ヒンジ押さえ板
105	6114-005645	2	Hinge ASSY	ヒンジASSY
106	6114-078988	2	Inverter unit collar	インバータBDカラ
201	6111-004058	1	Hinge cover 721	ヒンジ部カバ721
202	YZ-025D6	1	Operation panel cover	操作部ASSY
203	6114-033501	7	Key top (middle)	キートップ(中)
204	6114-033519	2	Key top (middle) with arrow	キートップ(中)矢印付
205	6114-033493B	1	Key top (big)	キートップ(大)
206	6113-010582	1	Rubber switch SW1	ラバーSW1
207	6113-010591	1	Rubber switch SW2	ラバーSW2
208	6113-011037B	1	Hinge base	ヒンジ基台
209	6112-009746	1	Recorder base cover 721	記録部カバー721
210	YZ-006H0	1	Top casing ASSY (for A version)	9320A用上部ケーシングASSY
	YZ-006H1	1	Top casing ASSY (for K version)	9320K用上部ケーシングASSY
	YZ-006H2	1	Top casing ASSY (for G version)	9320G用上部ケーシングASSY
211	6112-005616A	1	Top EMI plate	上部EMI基板
212	6114-034385A	1	Top casing bracket	上部取付板
213	6112-009352	1	9200 Card reader guide cover	9200カードリーダガイドフタ
213-1	6112-004733A	1	Card reader guide	カードリーダガイド
214	6144-005779	1	Platen axle ASSY	プラテン軸ASSY
215	6144-034108A	1	Magazine paper guide (top)	マガジン紙ガイド1
216	6111-001872B	1	Magazine	マガジン
217	6114-034117A	1	Magazine paper guide (bottom)	マガジン紙ガイド2
218	2249-000983A	1	Platen roller (216) ASSY	プラテンローラ(216)ASSY
219	294397	1	E-ring retainer E-32	EリングE-32
220	294949	2	Bearing SS5-8ZZ	ベアリング SS5-8ZZ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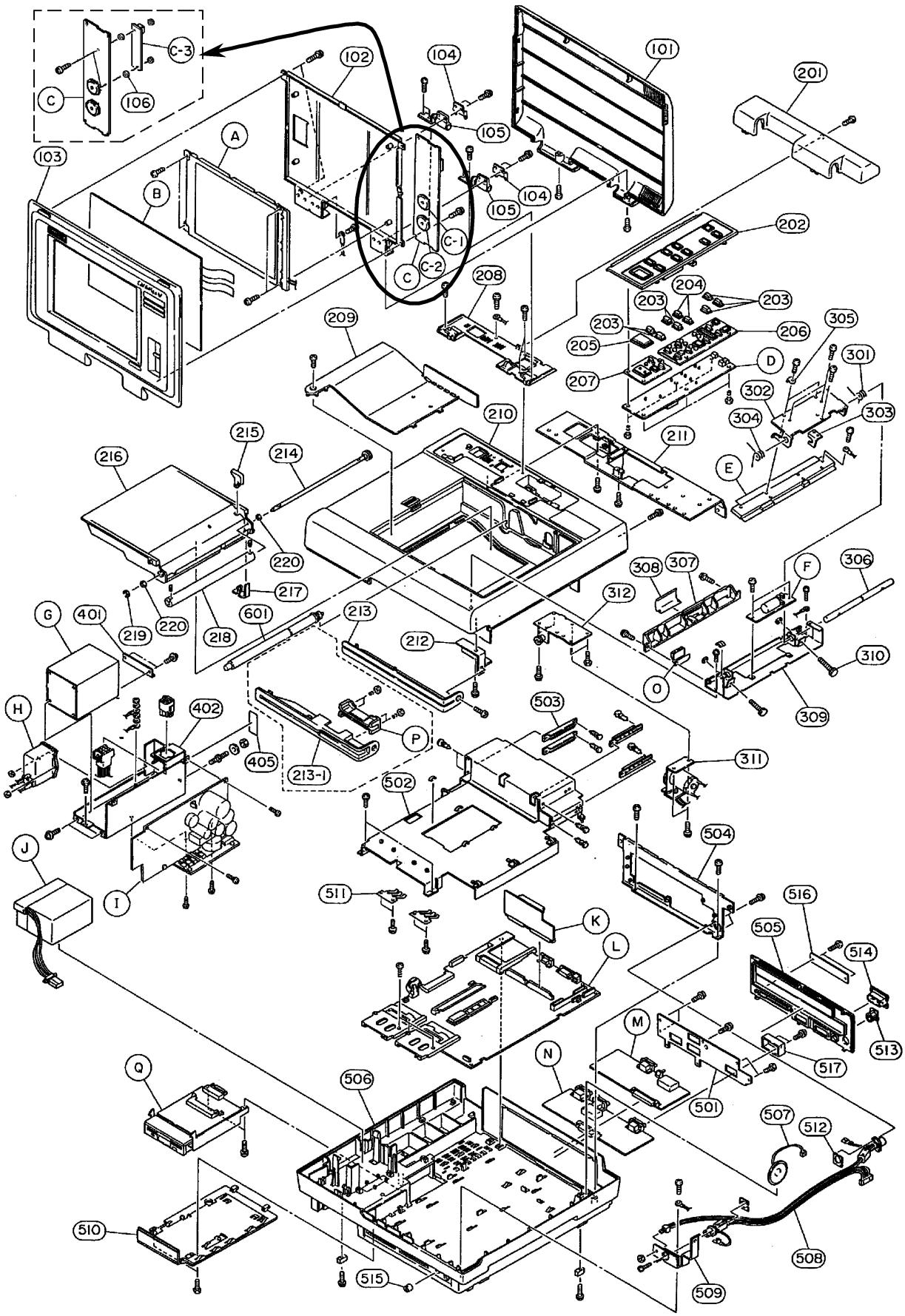
301	6114-034572A	1	Rear TH spring	ヘッドバネ(ウシロ)
302	6113-011046A	1	TH plate	ヘッドイタ
303	6114-034536A	1	TH guide	ヘッドガイド
304	6114-034563A	1	Front TH spring	ヘッドバネ(前)
305	6114-034474A	2	Grounding bracket	除電金具
306	6114-034545B	1	TH axle	ヘッド軸
307	6113-025967	1	Paper guide 721	紙ガイド721
308	6114-034438B	2	Tension plate	テンション板
309	6112-004804B	1	Paper feeder base plate	搬送部基板
310	6114-034456C	2	Aligning screw	位相ネジ
311	YZ-026D1	1	Motor ASSY	9000 モータ ASSY
312	YZ-026D3	1	Motor-gear base ASSY	駆動ギヤASSY
401	6114-033885A	1	Transformer holder	トランス金具
402	6112-004671A	1	Power base	電源基板
501	6123-006612A	1	Optional board cover	オプションBDパネル
502	6111-001783C	1	Shield plate (top)	シールド板(上)
503	440239	4	FG Guide rail FGR-80WSP	FGガイドレール FGR-80WSP
504	6113-011073C	1	Rear panel base	背面基板
505	6112-009764	1	Rear panel 721	背面ブタ721
506	YZ-006H6	1	Bottom casing ASSY	9000 下部ケーシングASSY
507	YZ-025D9	1	Speaker ASSY	9000 スピーカ ASSY
508	YZ-025D8	1	ECG Input socket ASSY	9000 入力端子ASSY
509	6114-034518B	1	Patient connector holder	患者コネクタ取付板
510	YZ-006H9	1	FD cover ASSY (721)	FD板ASSY (721)
511	6114-034367	2	Memory card spring	ICカードバネ
512	6114-034394A	2	Input box socket ASSY nut	コネクタナット板
513	6114-079185	1	9200 Bar code reader socket cover	9200バーコード蓋
514	6113-025521	1	9200 External input/output socket cover	9200EXTコネクタ蓋
515	6114-038425	1	Jack cover	ジャックカバー
516	6114-079194	1	IC card slot cover	ICカード蓋(グレー)
517	6114-038434	1	Connector cover	コネクタカバ
601	YZ-026D5	1	Paper axle ASSY	9000 紙軸ASSY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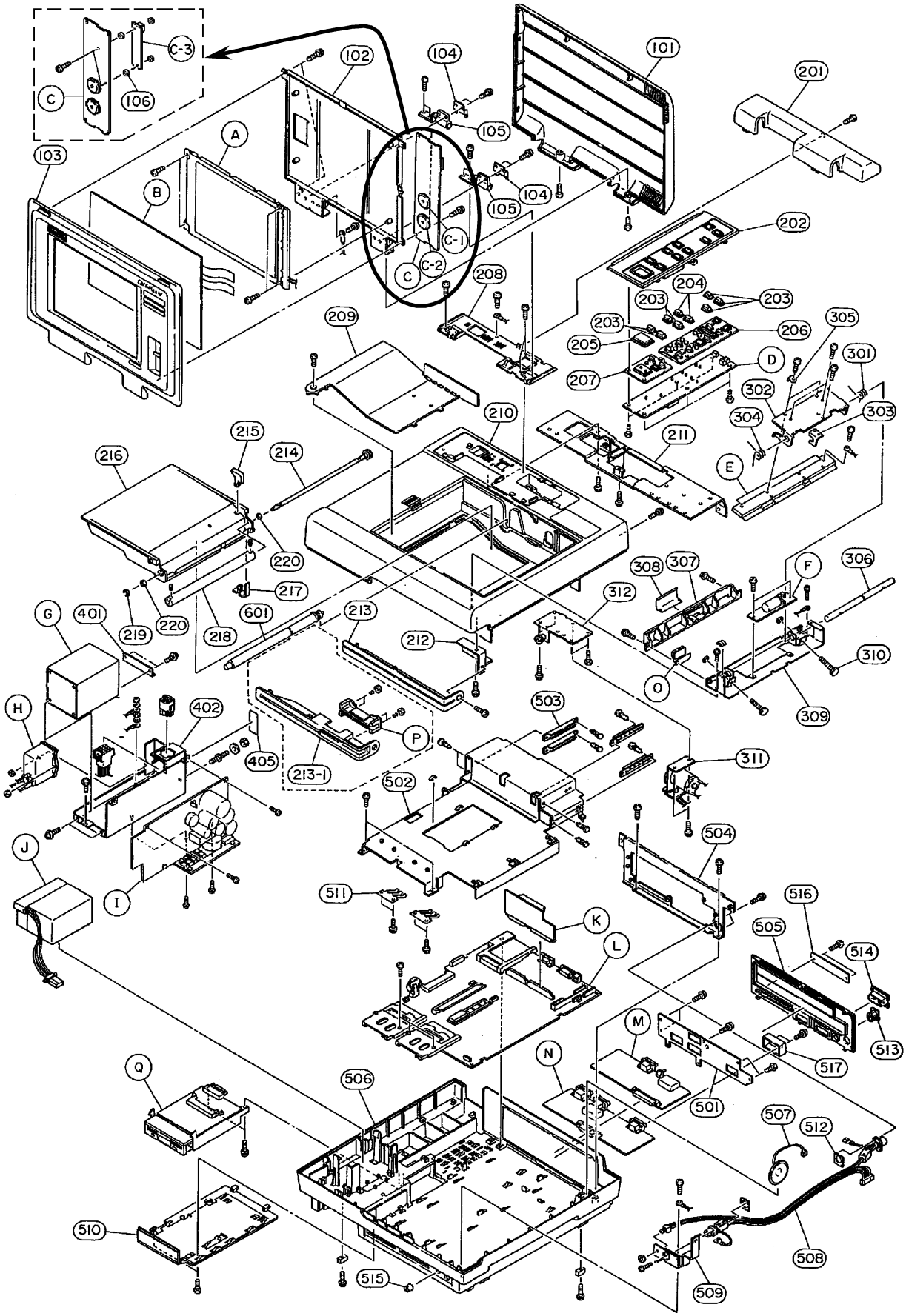
NOTE

- **C-1 and C-2 are available as parts of the LCD KEY BD.**
- **The parts marked with * are options of the instrument.**

A	518468	1	LCD module LRUGB6121A	LCDモジュール LRUGB6121A
B	6144-006858B	1	Touch panel ASSY	タッチパネルASSY
C	UT-2349	1	LCD KEY BD	LCDキーコントロールBD
C-1	YZ-009H3	1	Brightness VR ASSY	9000 輝度VR ASSY
C-2	YZ-009H4	1	Contrast VR ASSY	9000 コントVR ASSY
C-3	518316	1	Inverter unit	DC-ACインバータユニット CXA-L0612-VML
D	UT-2326	1	KEY BD	キーBD
E	YZ-025D7	1	9000 Thermal head ASSY	9000 サーマルヘッド ASSY
F	240045B	1	Capacitor UVR1V472MHA 35 V 4700 µF (CHARGE PUMP BD)	UVR1V472MHA 35 V 4700 µF コンデンサ (チャージポンプBD)
G	427789B	1	Transformer T-427789B	T-427789B ECG-9000電源トランス
H	332187A	1	AC inlet FN284B-2/06	ACインレット FN284B-2/06
I	UT-2324	1	POWER BD	電源BD
J	442843A	1	Battery LC-S2912NK	BATT LC-S2912NK
K	UT-2350	1	OPTION SLOT BD	オプションスロットBD
L	UT-2348	1	CONTROL BD	コントロールBD
M	UT-2333	1	SLAVE MONITOR BD*	スレーブモニタBD
N	UT-2334	1	EXTENSION I/O BD*	EXTENSION I/O BD
O	YZ-026D6	1	PAPER SENSORS ASSY	9000 紙センサーASSY
P	447802	1	QI-911E Magnetic card reader*	MR-2005-001 (QI-911E)
	447811	1	QI-912E Magnetic card reader*	MR-2006-001 (QI-912E)
Q	QM-501D	1	Floppy disk unit*	フロッピーディスクユニット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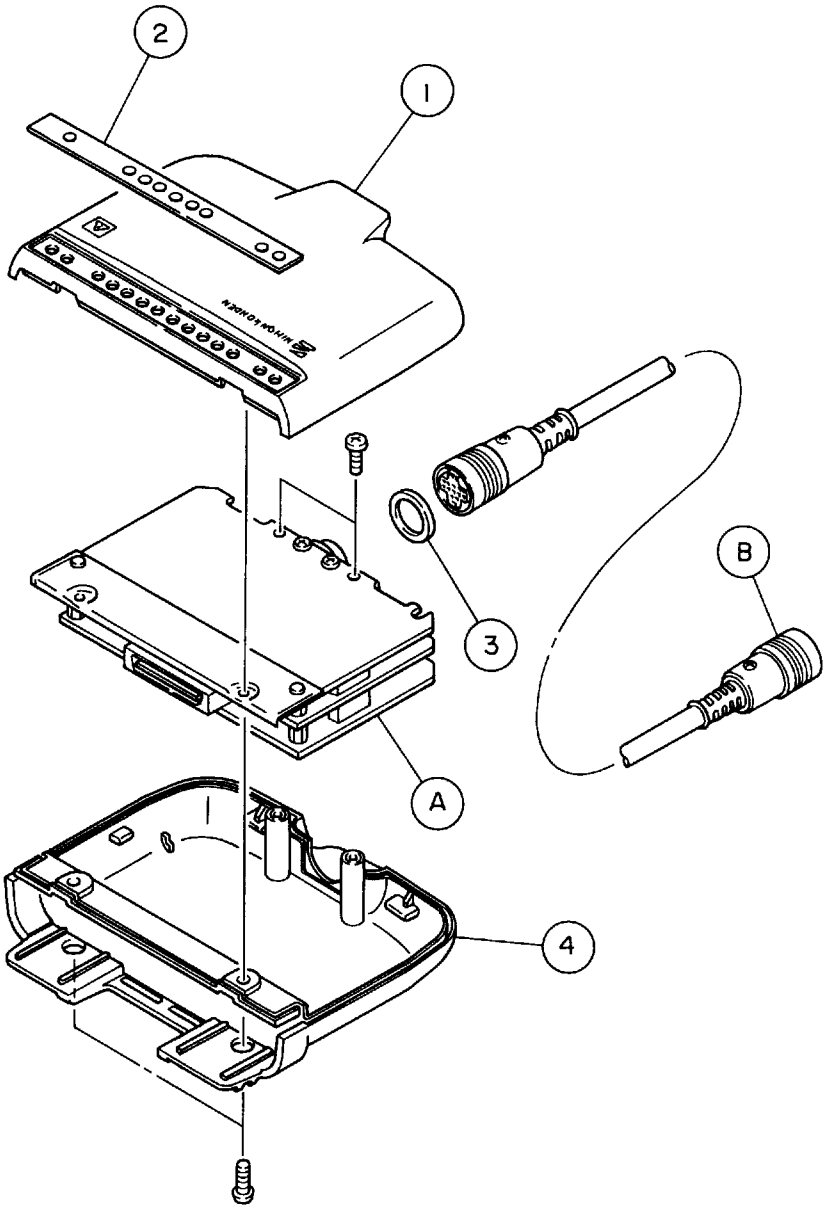
9-2 BJ-911D Input Box

9-2-1 JC-901D Input Box

Index	NK Parts No.	QTY	Description	
1	6112-004867A	1	Box top casing	上部本体
2	6144-005966B	1	LED label	LEDラベル12 ASSY
3	6114-034919	1	Connector rubber seal	コネクタシールゴム
4	6112-004876B	1	Box bottom casing	下部本体
A	UT-2329	1	INPUT BOX BD	入力BD
B	443245	1	Input box cable (2 m)	INPUT BOX用通信デーブル(2m)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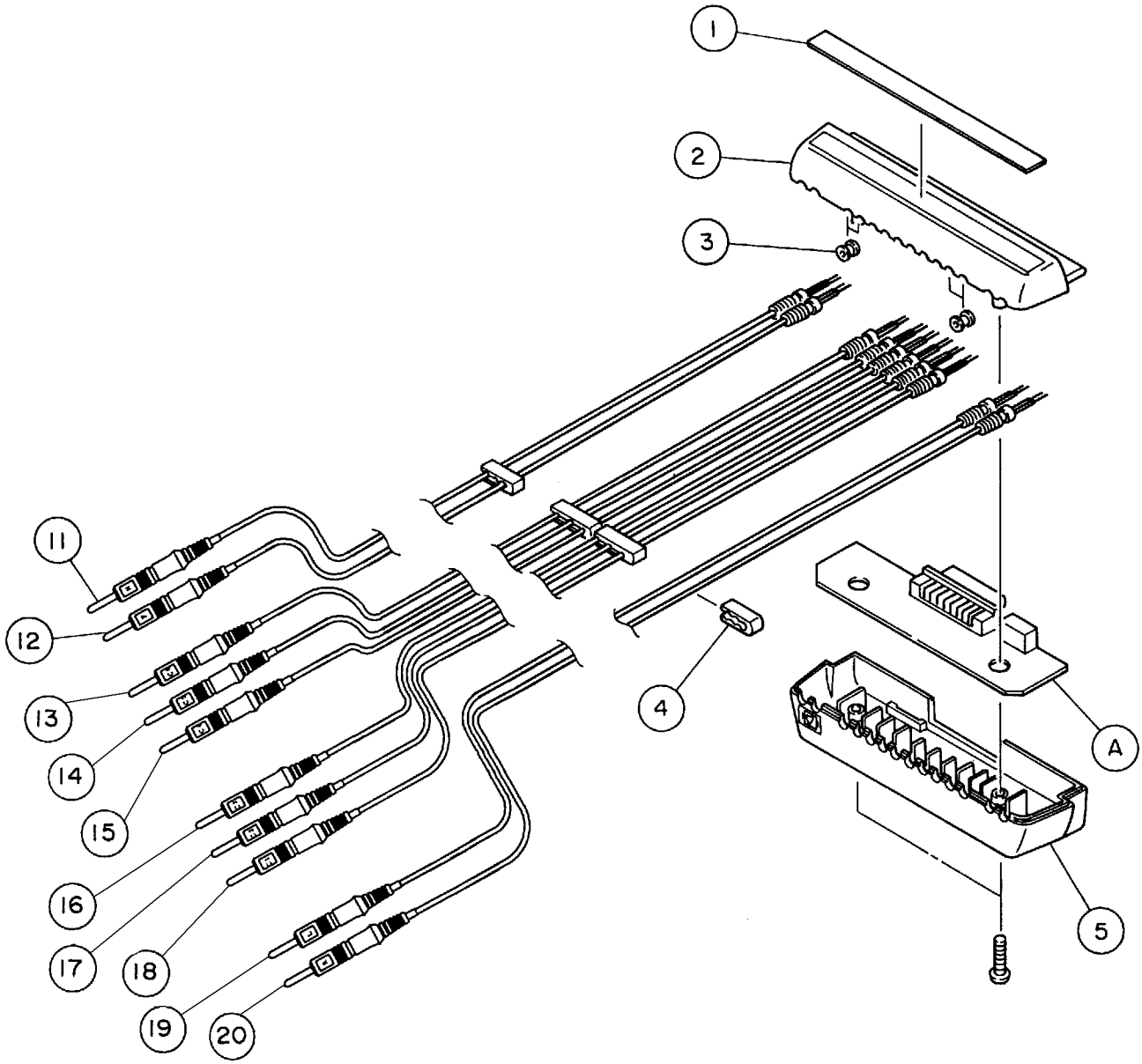
9-2-2 BR-911D (ϕ3) Electrode Leads Cartridge

Index	NK Parts No.	QTY	Description	
1	6124-018152	1	Leads label	誘導ラベル12
2	6112-004885A	1	Cartridge top	カートリッジ上部
3	6114-034973A	4	Nylon lead bush	リートブッシュ ナイロン66
4	6114-034982A	8	Nylon leads clamp	リードクランプ ナイロン66
5	6112-004894A	1	Cartridge bottom	カートリッジ下部
11	6143-004015B	1	N ϕ3 Lead cable ASSY	誘導コードN(ϕ3)ASSY
12	6143-004006B	1	F ϕ3 Lead cable ASSY	誘導コードF(ϕ3)ASSY
13	6143-003854B	1	C6 ϕ3 Lead cable ASSY	誘導コードC6(ϕ3)ASSY
14	6143-003845B	1	C5 ϕ3 Lead cable ASSY	誘導コードC5(ϕ3)ASSY
15	6143-003836B	1	C4 ϕ3 Lead cable ASSY	誘導コードC4(ϕ3)ASSY
16	6143-003827B	1	C3 ϕ3 Lead cable ASSY	誘導コードC3(ϕ3)ASSY
17	6143-003818B	1	C2 ϕ3 Lead cable ASSY	誘導コードC2(ϕ3)ASSY
18	6143-003809B	1	C1 ϕ3 Lead cable ASSY	誘導コードC1(ϕ3)ASSY
19	6143-003997B	1	L ϕ3 Lead cable ASSY	誘導コードL(ϕ3)ASSY
20	6143-003988B	1	R ϕ3 Lead cable ASSY	誘導コードR(ϕ3)ASSY
A	YZ-028D8	1	ECG-9000 CONNECT BD ASSY	ECG-9000 CONNECT BD ASSY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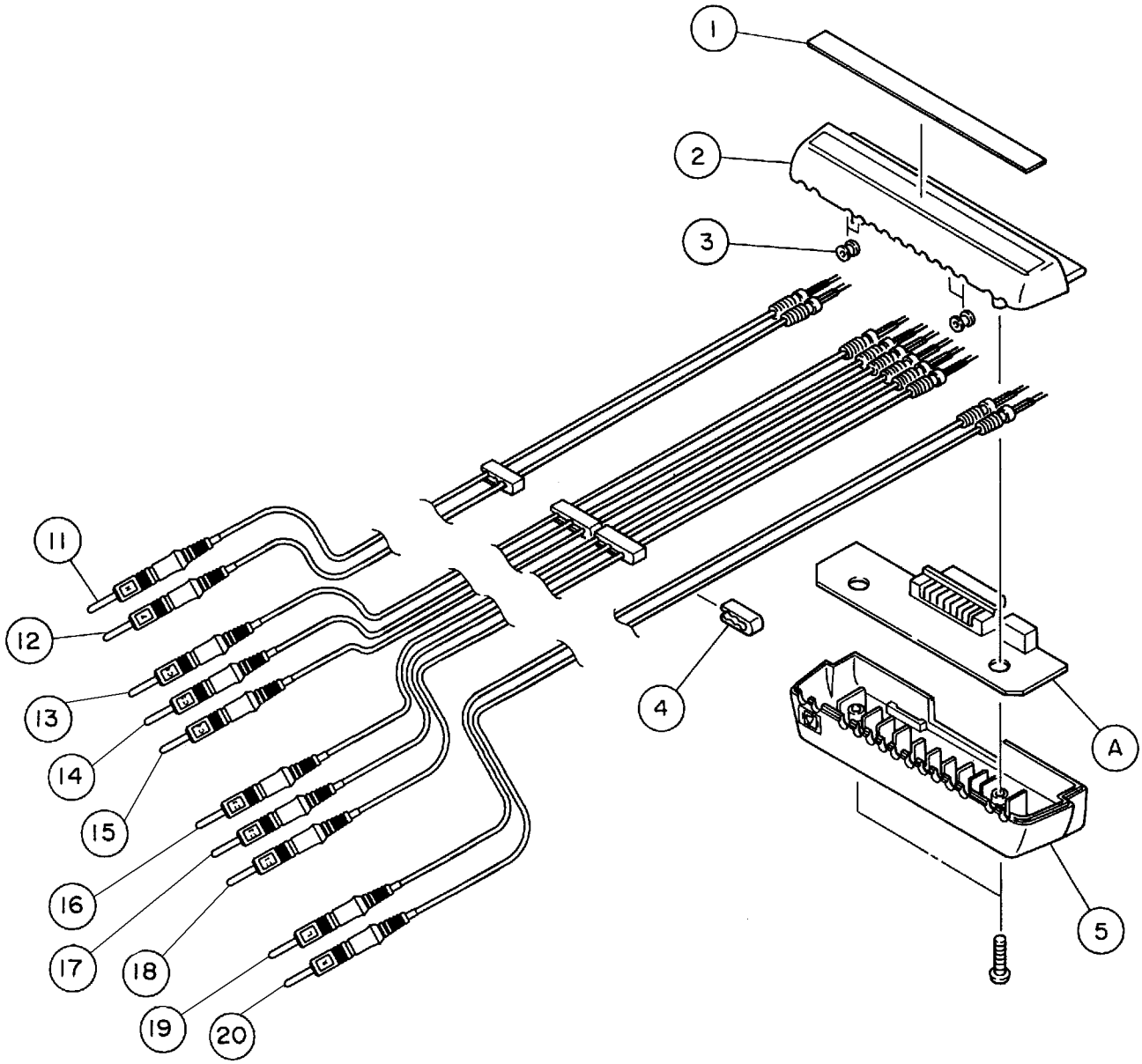
9-2-3 BR-911DA (φ3) Electrode Leads Cartridge

Index	NK Parts No.	QTY	Description	
1	6124-018161	1	Leads label 12A	誘導ラベル12A
2	6112-004885B	1	Cartridge top	カートリッジ上部
3	6114-034973A	4	Nylon lead bush	リートブッシュ ナイロン66
4	6114-034982A	8	Nylon leads clamp	リードクランプ ナイロン66
5	6112-004894B	1	Cartridge bottom	カートリッジ下部
11	6143-004033	1	LA φ3 Lead cable ASSY	誘導コードLA(φ3)ASSY
12	6143-004051	1	LL φ3 Lead cable ASSY	誘導コードLL(φ3)ASSY
13	6143-003952	1	V6 φ3 Lead cable ASSY	誘導コードV6(φ3)ASSY
14	6143-003943	1	V5 φ3 Lead cable ASSY	誘導コードV5(φ3)ASSY
15	6143-003934	1	V4 φ3 Lead cable ASSY	誘導コードV4(φ3)ASSY
16	6143-003925	1	V3 φ3 Lead cable ASSY	誘導コードV3(φ3)ASSY
17	6143-003916	1	V2 φ3 Lead cable ASSY	誘導コードV2(φ3)ASSY
18	6143-003907	1	V1 φ3 Lead cable ASSY	誘導コードV1(φ3)ASSY
19	6143-004042	1	RL φ3 Lead cable ASSY	誘導コードRL(φ3)ASSY
20	6143-004024	1	RA φ3 Lead cable ASSY	誘導コードRA(φ3)ASSY
A	YZ-028D8	1	ECG-9000 CONNECT BD ASSY	ECG-9000 CONNECT BD ASSY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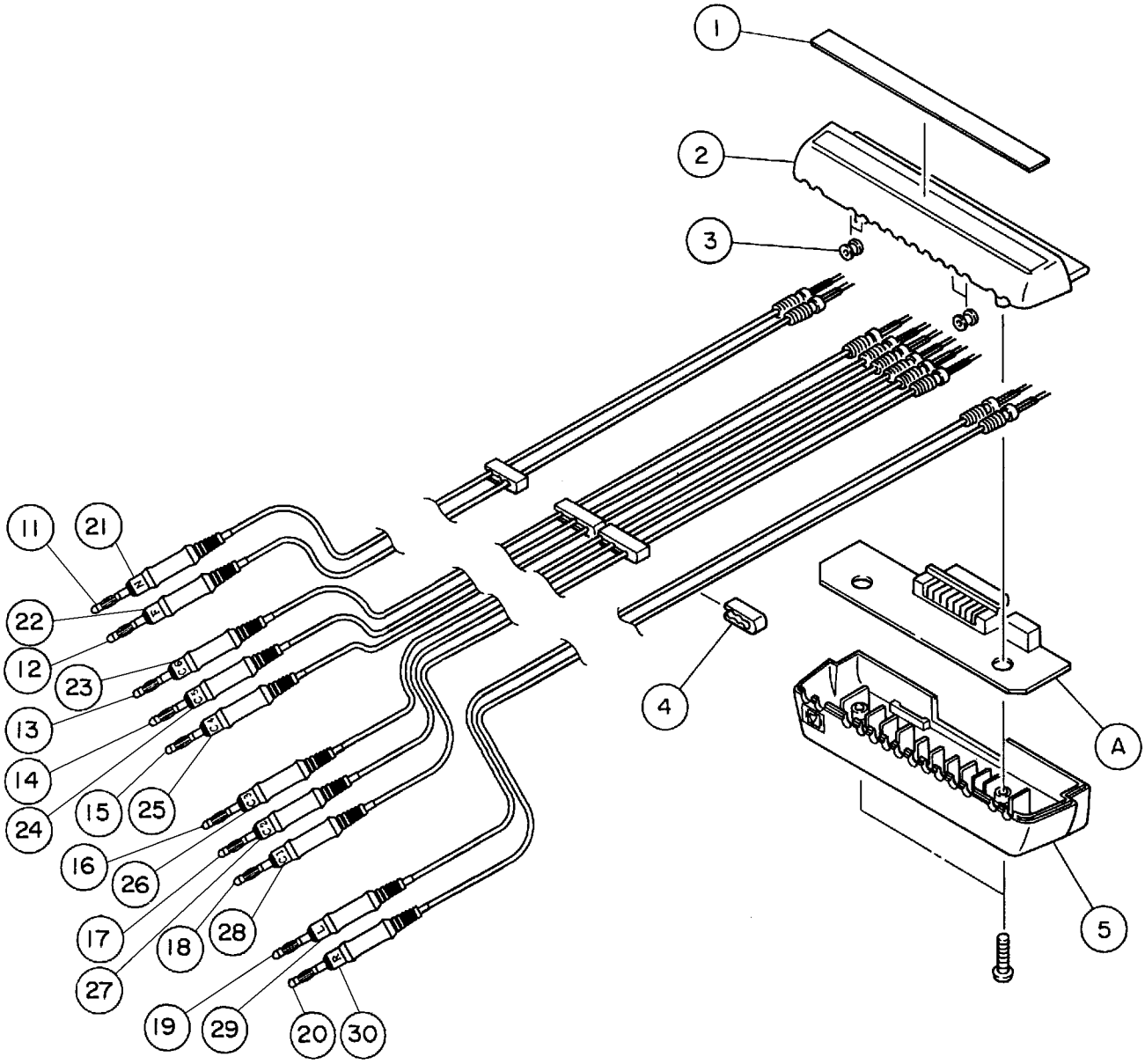
9-2-4 BR-912D (ϕ4) Electrode Leads Cartridge

Index	NK Parts No.	QTY	Description	
1	6124-018152	1	Leads label	誘導ラベル12
2	6112-004885A	1	Cartridge top	カートリッジ上部
3	6114-034973A	4	Nylon lead bush	リートブッシュ ナイロン66
4	6114-034982A	8	Nylon leads clamp	リードクランプ ナイロン66
5	6112-004894A	1	Cartridge bottom	カートリッジ下部
11	6143-005005A	1	N.ϕ4 Lead cable ASSY	誘導コード(N.ϕ4)ASSY
12	6143-004104B	1	R.L.F.ϕ4 Lead cable ASSY	誘導コード(R.L.Fϕ4)ASSY
13	6143-003899B	1	Chest ϕ4 Lead cable ASSY	誘導コード(胸部ϕ4)ASSY
14	6143-003899B	1	Chest ϕ4 Lead cable ASSY	誘導コード(胸部ϕ4)ASSY
15	6143-003899B	1	Chest ϕ4 Lead cable ASSY	誘導コード(胸部ϕ4)ASSY
16	6143-003899B	1	Chest ϕ4 Lead cable ASSY	誘導コード(胸部ϕ4)ASSY
17	6143-003899B	1	Chest ϕ4 Lead cable ASSY	誘導コード(胸部ϕ4)ASSY
18	6143-003899B	1	Chest ϕ4 Lead cable ASSY	誘導コード(胸部ϕ4)ASSY
19	6143-004104B	1	R.L.F.ϕ4 Lead cable ASSY	誘導コード(R.L.Fϕ4)ASSY
20	6143-004104B	1	R.L.F.ϕ4 Lead cable ASSY	誘導コード(R.L.Fϕ4)ASSY
21	2219-004839	1	N Label ring	文字リングN
22	2219-004768	1	F Label ring	文字リングF
23	2219-004821	1	C6 Label ring	文字リングC6
24	2219-004812	1	C5 Label ring	文字リングC5
25	2219-004803	1	C4 Label ring	文字リングC4
26	2219-004795	1	C3 Label ring	文字リングC3
27	2219-004786	1	C2 Label ring	文字リングC2
28	2219-004777	1	C1 Label ring	文字リングC1
29	2219-004741	1	L Label ring	文字リングL
30	2219-004732	1	R Label ring	文字リングR
A	YZ-028D8	1	ECG-9000 CONNECT BD ASSY	ECG-9000 CONNECT BD ASSY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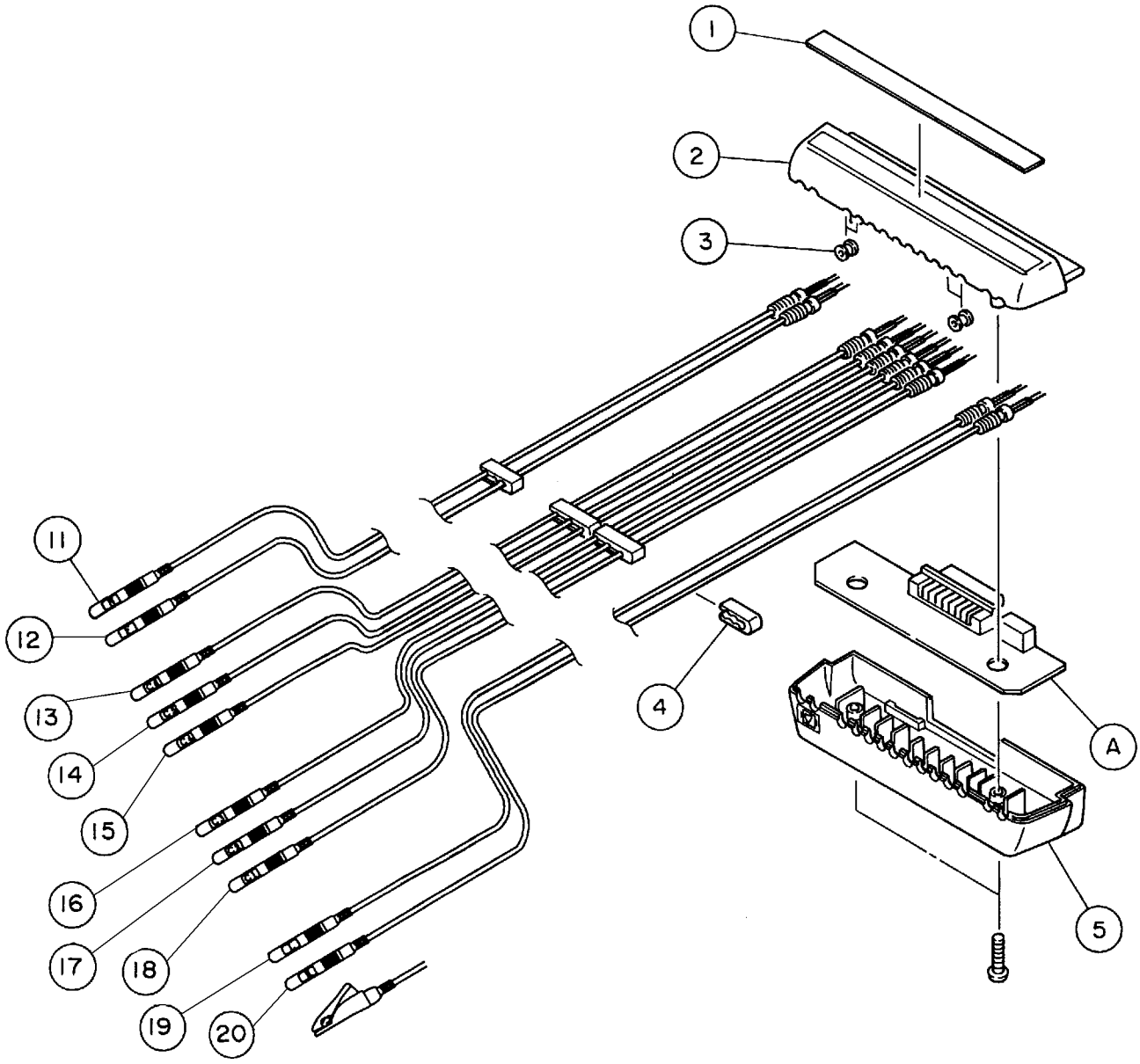
9-2-5 BR-913D (Clip) Electrode Leads Cartridge

Index	NK Parts No.	QTY	Description	
1	6124-018152	1	Leads label	誘導ラベル12
2	6112-004885B	1	Cartridge top	カートリッジ上部
3	6114-034973A	4	Nylon lead bush	リートブッシュ
4	6114-034982A	8	Nylon leads clamp	リードクランプ
5	6112-004894B	1	Cartridge bottom	カートリッジ下部
11	6143-006192	1	N Clip-lead cable ASSY	クリップASSY N
12	6143-006183	1	F Clip-lead cable ASSY	クリップASSY F
13	6143-006254	1	C6 Clip-lead cable ASSY	クリップASSY C6
14	6143-006245	1	C5 Clip-lead cable ASSY	クリップASSY C5
15	6143-006236	1	C4 Clip-lead cable ASSY	クリップASSY C4
16	6143-006227	1	C3 Clip-lead cable ASSY	クリップASSY C3
17	6143-006218	1	C2 Clip-lead cable ASSY	クリップASSY C2
18	6143-006209	1	C1 Clip-lead cable ASSY	クリップASSY C1
19	6143-006174	1	L Clip-lead cable ASSY	クリップASSY L
20	6143-006165	1	R Clip-lead cable ASSY	クリップASSY R
A	YZ-028D8	1	ECG-9000 CONNECT BD ASSY	ECG-9000 CONNECT BD ASSY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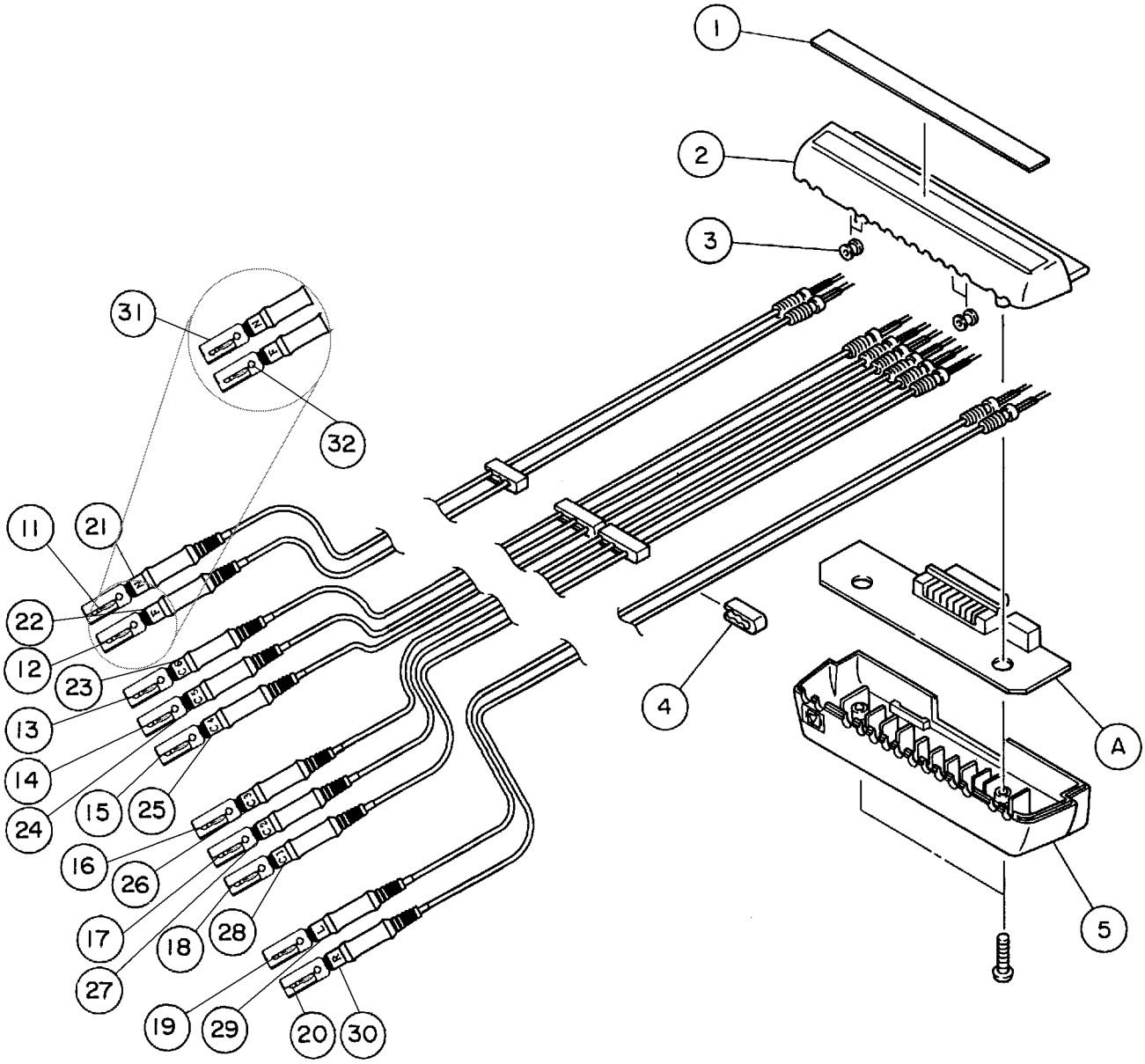
9-2-6 BR-912DG (φ4) Electrode Leads Cartridge (With Cover)

Index	NK Parts No.	QTY	Description	
1	6124-018152	1	Leads label	誘導ラベル12
2	6112-004885A	1	Cartridge top	カートリッジ上部
3	6114-034973A	4	Nylon lead bush	リートブッシュ ナイロン66
4	6114-034982A	8	Nylon leads clamp	リードクランプ ナイロン66
5	6112-004894A	1	Cartridge bottom	カートリッジ下部
11	6143-005005A	1	N.φ4 Cap lead cable ASSY	誘導コード(N.φ4)ASSY
12	6143-004104B	1	R.L.F.φ4 Cap lead cable ASSY	誘導コード(R.L.Fφ4)ASSY
13	6143-003899B	1	Chest φ4 Cap lead cable ASSY	誘導コード(胸部φ4)ASSY
14	6143-003899B	1	Chest φ4 Cap lead cable ASSY	誘導コード(胸部φ4)ASSY
15	6143-003899B	1	Chest φ4 Cap lead cable ASSY	誘導コード(胸部φ4)ASSY
16	6143-003899B	1	Chest φ4 Cap lead cable ASSY	誘導コード(胸部φ4)ASSY
17	6143-003899B	1	Chest φ4 Cap lead cable ASSY	誘導コード(胸部φ4)ASSY
18	6143-003899B	1	Chest φ4 Cap lead cable ASSY	誘導コード(胸部φ4)ASSY
19	6143-004104B	1	R.L.F.φ4 Cap lead cable ASSY	誘導コード(R.L.Fφ4)ASSY
20	6143-004104B	1	R.L.F.φ4 Cap lead cable ASSY	誘導コード(R.L.Fφ4)ASSY
21	2219-004839	1	N Label ring	文字リングN
22	2219-004768	1	F Label ring	文字リングF
23	2219-004821	1	C6 Label ring	文字リングC6
24	2219-004812	1	C5 Label ring	文字リングC5
25	2219-004803	1	C4 Label ring	文字リングC4
26	2219-004795	1	C3 Label ring	文字リングC3
27	2219-004786	1	C2 Label ring	文字リングC2
28	2219-004777	1	C1 Label ring	文字リングC1
29	2219-004741	1	L Label ring	文字リングL
30	2219-004732	1	R Label ring	文字リングR
31	6114-011837	10	Tip cover	チップサキカバ
32	355126	10	Hexagon socket screw M3×3	6角穴付止めネジM3×3
A	YZ-028D8	1	ECG-9000 CONNECT BD ASSY	ECG-9000 CONNECT BD ASSY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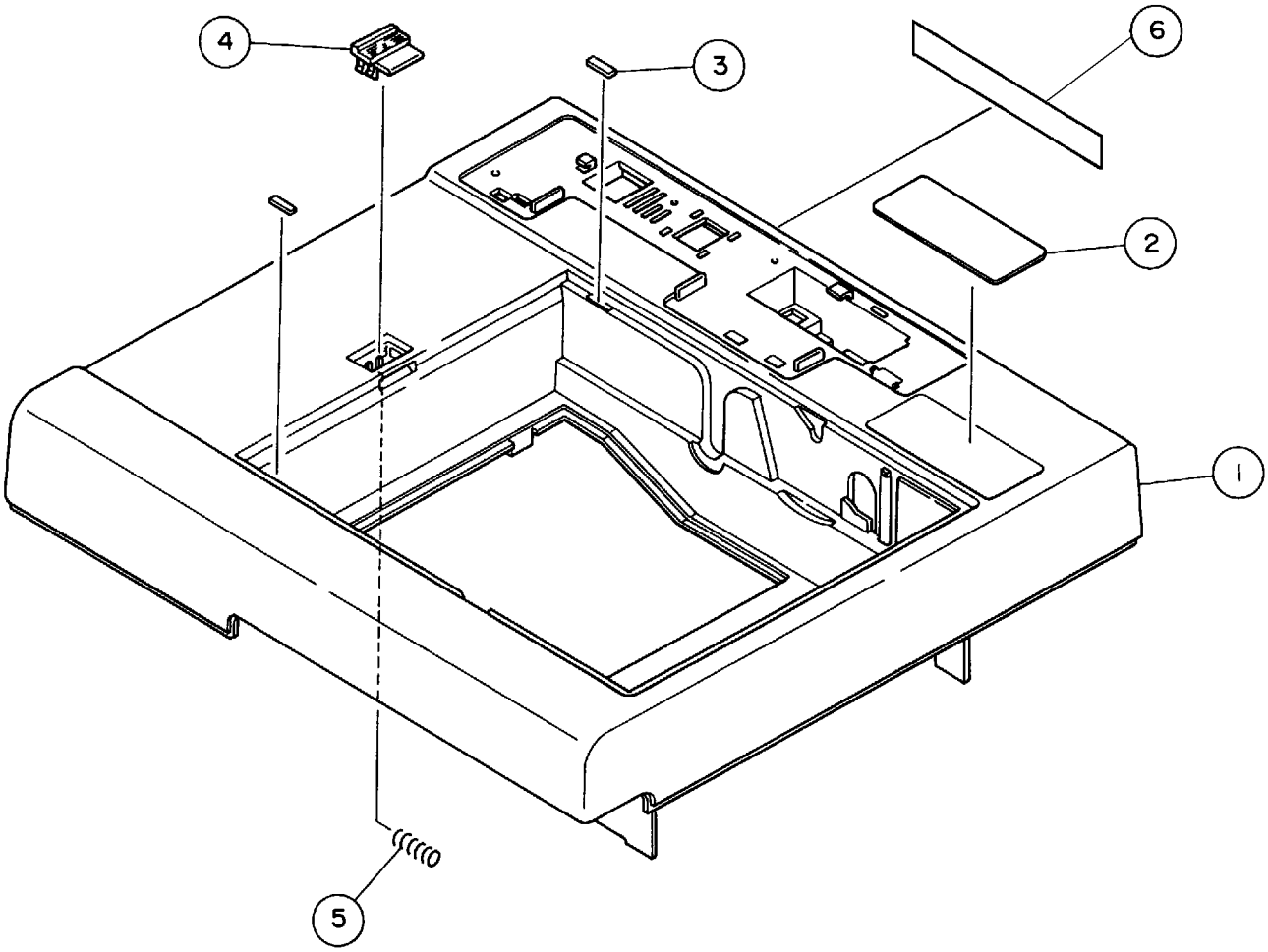
9-3 Assemblies (ASSY)

9-3-1 YZ-006H0 Top Casing ASSY (for A Version)

Index	NK Parts No.	QTY	Description	
1	6111-003986	1	Top casing 721	上部721
2	6124-019418B	1	Caution label	注意銘板
3	6114-034429A	2	Magazine damper rubber	マガジンダンパゴム
4	6113-025976	1	Magazine release lever 721	マガジンボタン721
5	295422	1	Coil spring	圧縮コイルバネ
6	6123-005872	1	CSA label	CSA注意銘板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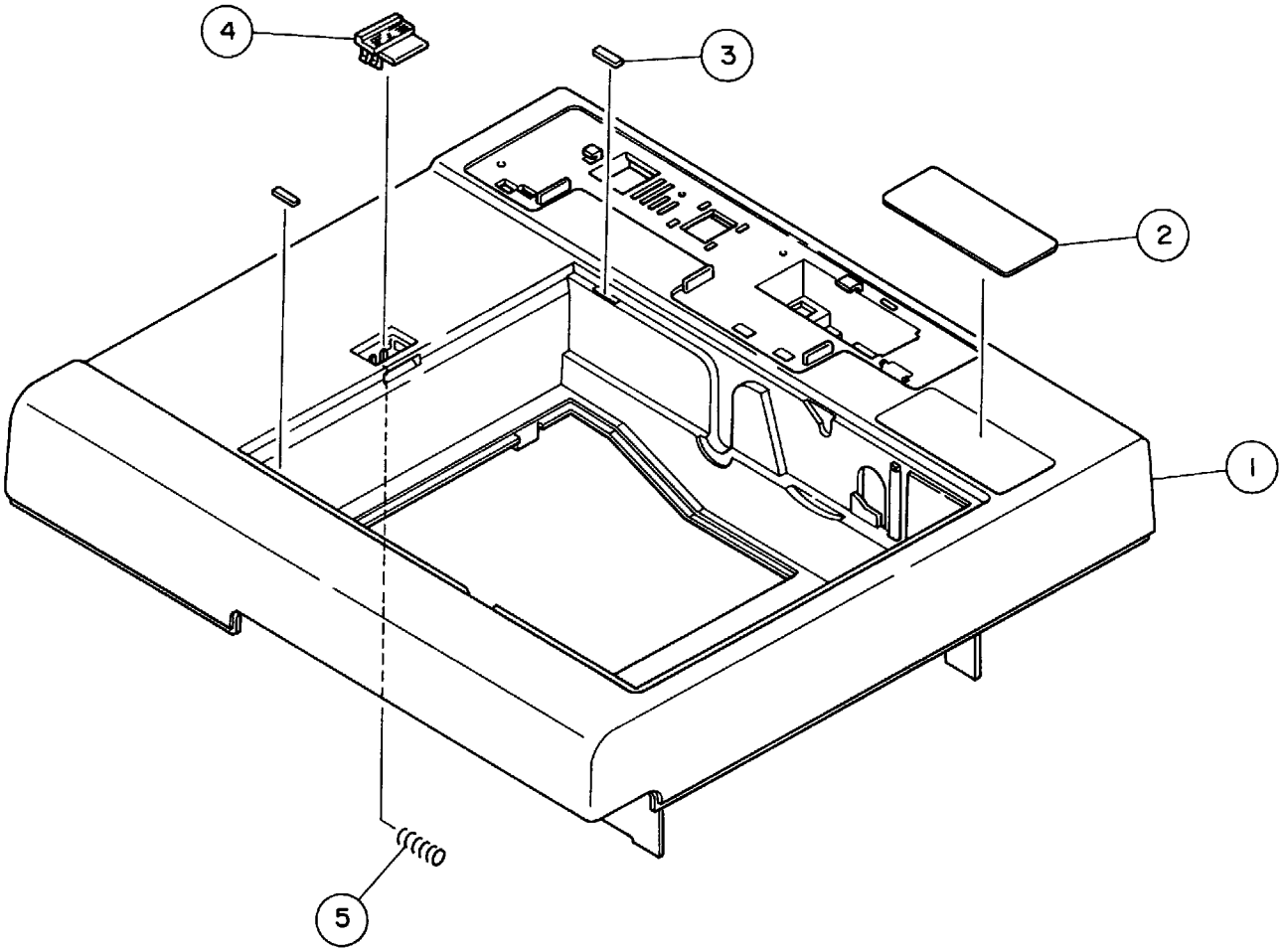
9-3-2 YZ-006H1 Top Casing ASSY (for K Version)

Index	NK Parts No.	QTY	Description	
1	6111-003986	1	Top casing 721	上部721
2	6124-019418B	1	Caution label	注意銘板
3	6114-034429A	2	Magazine damper rubber	マガジンダンパゴム
4	6113-025976	1	Magazine release lever 721	マガジンボタン721
5	295422	1	Coil spring	圧縮コイルバネ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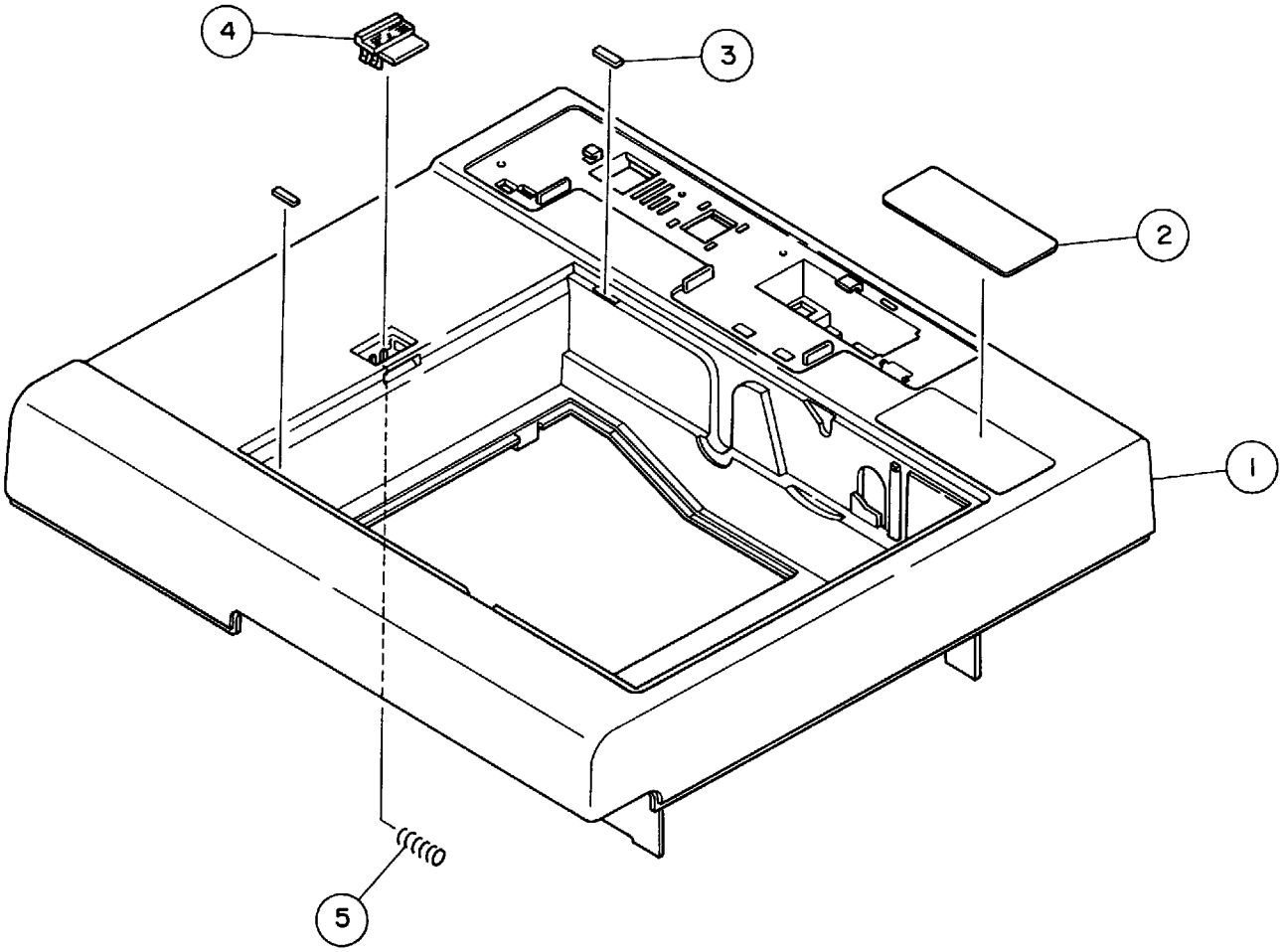
9-3-3 YZ-006H2 Top Casing ASSY (for G Version)

Index	NK Parts No.	QTY	Description	
1	6111-003986	1	Top casing 721	上部721
2	6124-021932	1	Caution label G	注意銘板G
3	6114-034429A	2	Magazine damper rubber	マガジンダンパゴム
4	6113-025976	1	Magazine release lever 721	マガジンボタン721
5	295422	1	Coil spring	圧縮コイルバネ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9-3-4 YZ-006H3 9320A LCD Front Panel ASSY

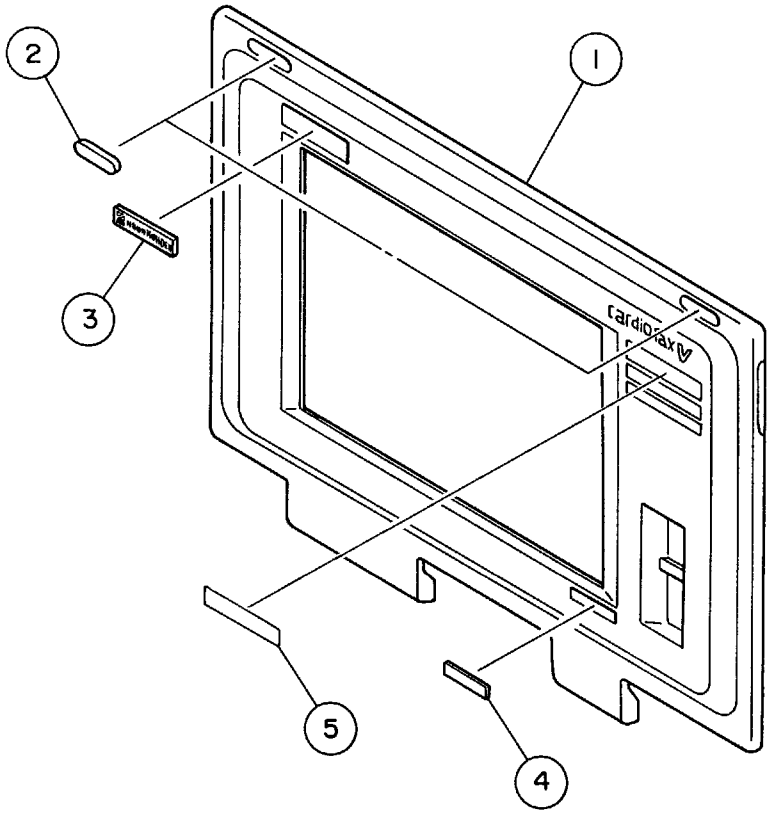
Index	NK Parts No.	QTY	Description	
1	6111-004049	1	LCD front panel 721	LCD前パネル721
2	6114-034358A	2	Rubber absorber	緩衝ゴム
3	6124-026508	3	Name plate 40 (721)	社名プレート40 (721)
4	6124-019436	1	ECG-9320A seal	ECG-9320A シール
5	6124-020247	1	9320 seal	9320機種判別シール

9-3-5 YZ-006H4 9320K LCD Front Panel ASSY

Index	NK Parts No.	QTY	Description	
1	6111-004049	1	LCD front panel 721	LCD前パネル721
2	6114-034358A	2	Rubber absorber	緩衝ゴム
3	6124-026508	3	Name plate 40 (721)	社名プレート40 (721)
4	6124-019454	1	ECG-9320K seal	ECG-9320K シール
5	6124-020247	1	9320 seal	9320機種判別シール

9-3-6 YZ-006H5 9320G LCD Front Panel ASSY

Index	NK Parts No.	QTY	Description	
1	6111-004049	1	LCD front panel 721	LCD前パネル721
2	6114-034358A	2	Rubber absorber	緩衝ゴム
3	6124-026508	3	Name plate 40 (721)	社名プレート40 (721)
4	6124-019463	1	ECG-9320G seal	ECG-9320G シール
5	6124-020247	1	9320 seal	9320機種判別シール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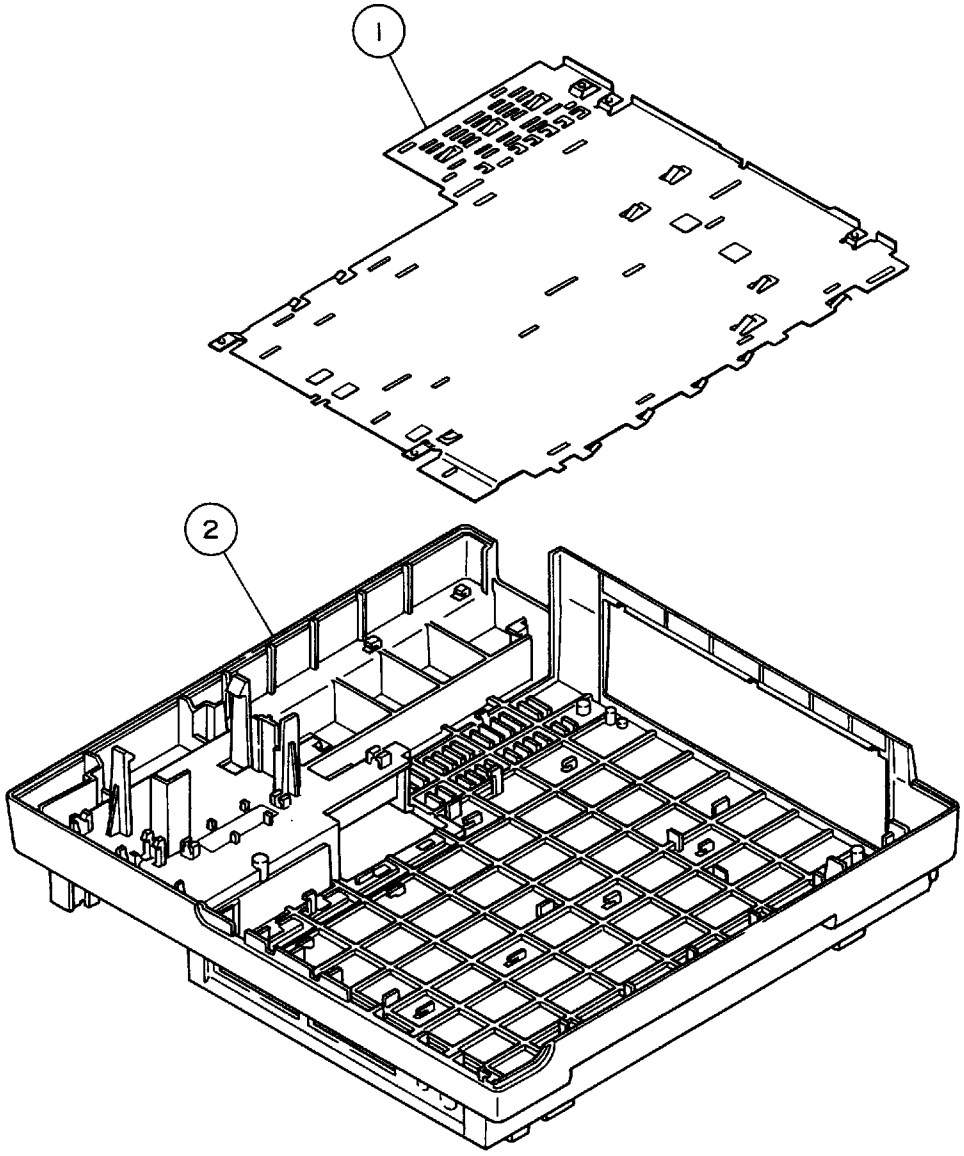
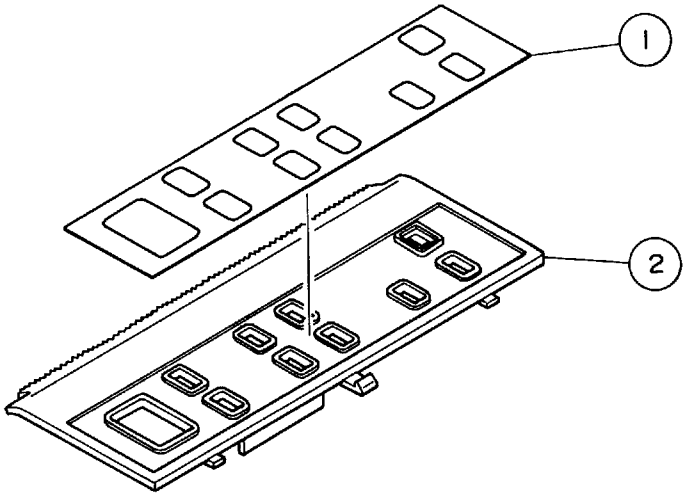
9-3-7 YZ-006H6 Bottom Casing ASSY

Index	NK Parts No.	QTY	Description	
1	6111-001774C	1	Ground plate	アース板
2	6111-004013	1	Bottom casing 721	下部721



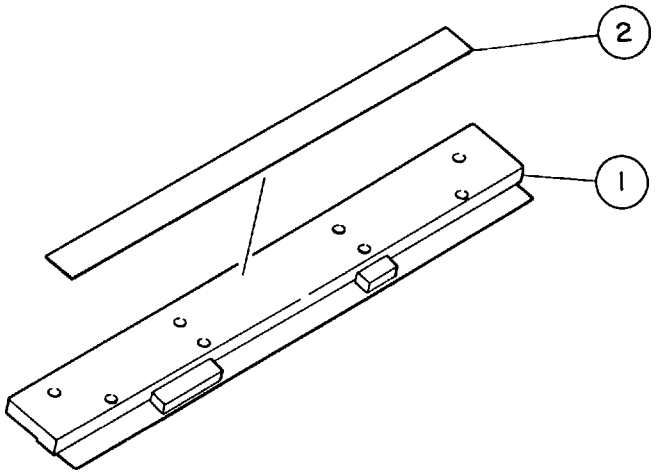
9-3-8 YZ-025D6 Key Panel Cover ASSY

Index	NK Parts No.	QTY	Description	
1	6143-003676	1	Operation panel ASSY	操作部パネルASSY
2	6112-004662A	2	Key panel cover	操作部カバー



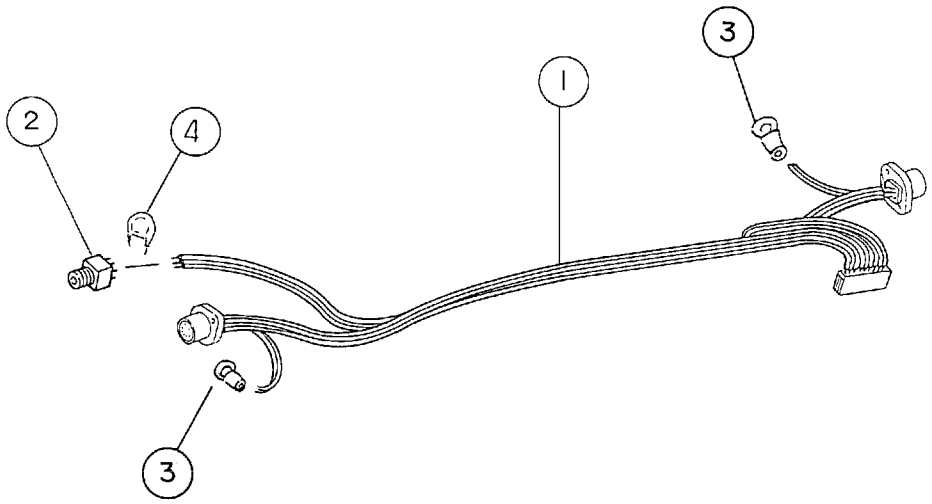
9-3-9 YZ-025D7 Thermal Head ASSY

Index	NK Parts No.	QTY	Description	
1	357035	1	Thermal head	サーマルヘッド
			KJT-216-8MPF1-NK	KJT-216-8MPF1-NK1
2	6114-034447A	1	Electrical insulation seal	除電シート



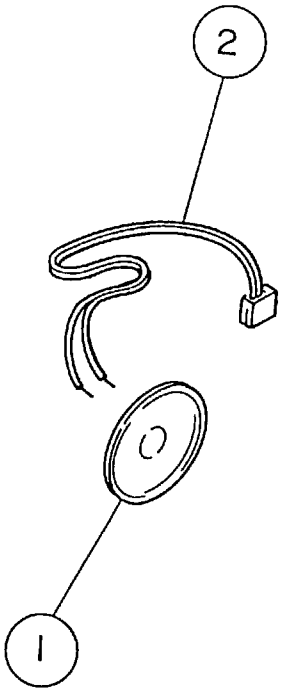
9-3-10 YZ-025D8 Input Socket ASSY

Index	NK Parts No.	QTY	Description	
1	443325	1	INPUT CONT ASSY	
2	273731	1	Input jack	イヤホーンジャック HSJO296-01-150
3	313698	2	VD 1.25-M3	
4	046175	1	DD105SL101J 50V 100PF	



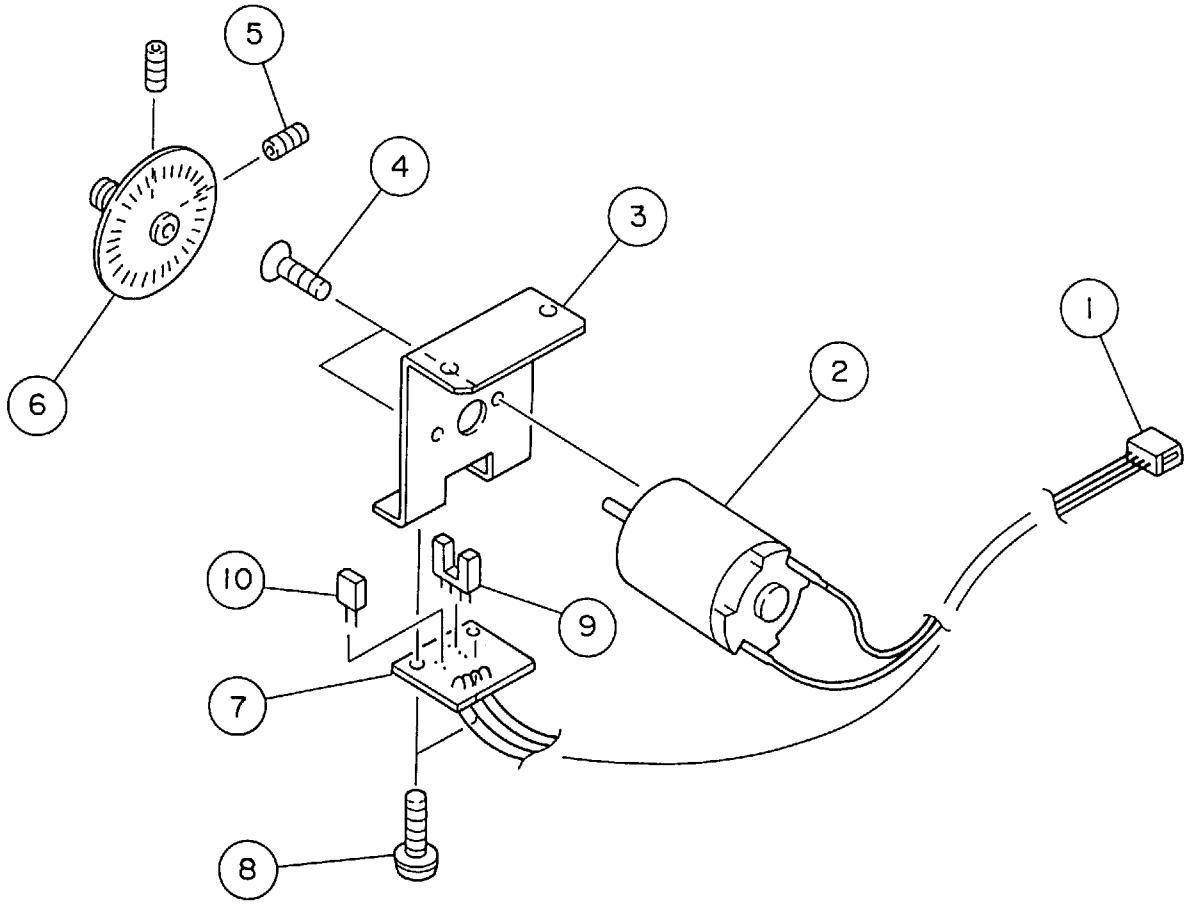
9-3-11 YZ-025D9 Speaker ASSY

Index	NK Parts No.	QTY	Description	
1	386235A	1	Speaker	T050S23A0000
2	444805	1	DF11-4DS-2C Connector cable	DF11-4DS-2C カタタン(CONT-SP)



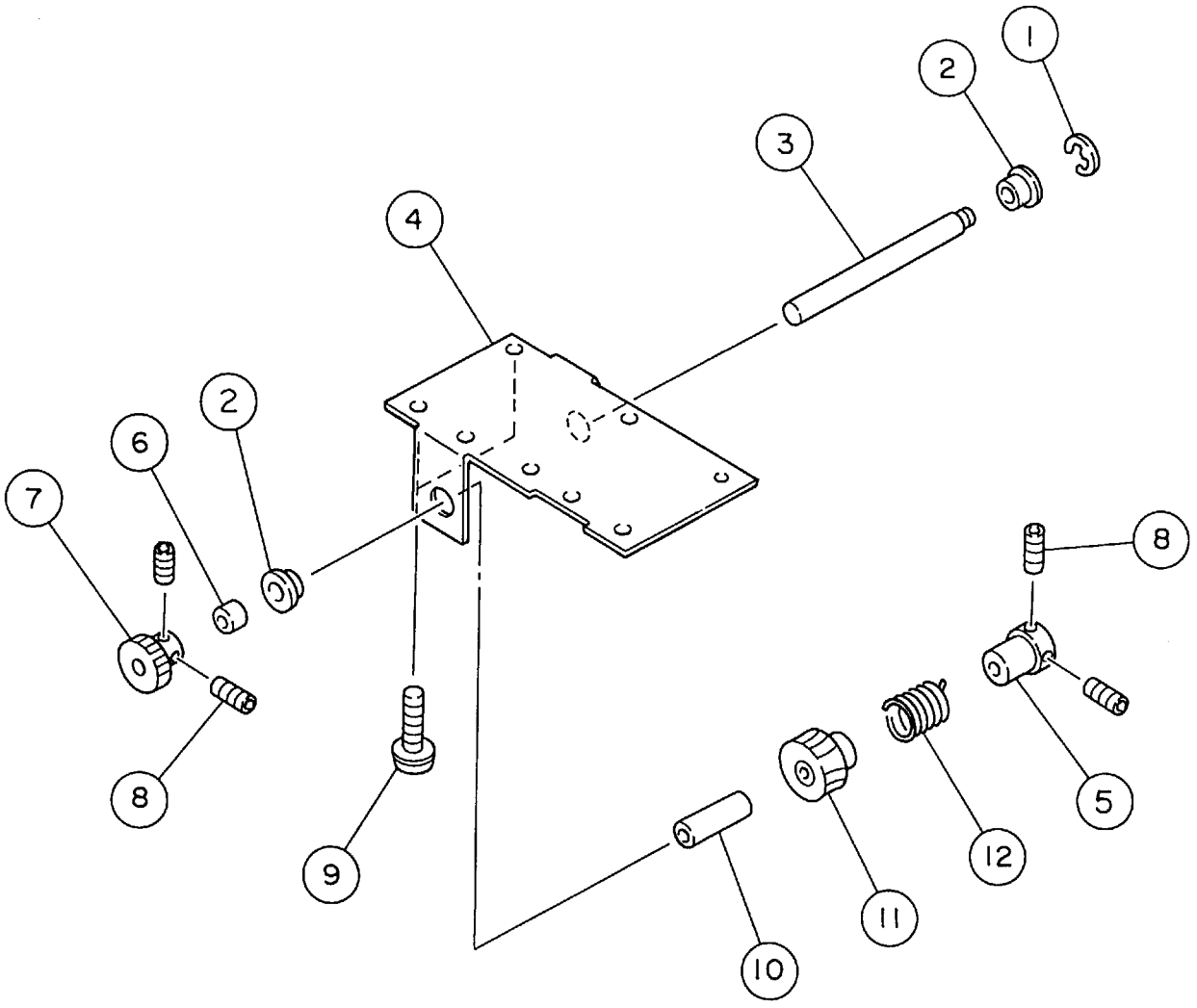
9-3-12 YZ-026D1 Motor ASSY

Index	NK Parts No.	QTY	Description	
1	443263	1	DF11-8DS-2C Connector cable	DF11-8DS-2C カタタン (CONT-MOT)
2	343986	1	Motor	DCモータ FN30-T253N1E
3	6114-034411A	1	Motor holder	モータ取付板
4	286441	1	Phillips screw F3×6	十字穴付皿小ネジF3×6
5	355091	2	Hexagon socket screw M2×3	6角穴付止めネジM2×3
6	6144-005752A	1	Worm ASSY	ウォームASSY
7	6190-005844	1	MOTOR SENS BD	MOTOR SENS BD
8		2	M3×6 screw with spring washer	セムスネジM3×6
9	387626	1	Photo-interrupter	ホトインタラプタ GP1A53HR
10	248545	1	Photo-diode	K104Z20Z5UF5TH5 50V 0.1μF



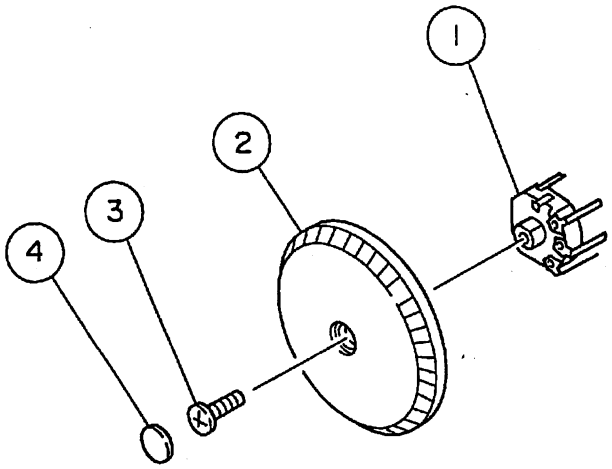
9-3-13 YZ-026D3 Motor-gear Base ASSY

Index	NK Parts No.	QTY	Description	
1	294379	1	E-ring E-24	E型トメワE-24
2	295164A	2	Miniature bearing	ミニチュアベアリング
			DDLF-850ZZH	DDLF-850ZZH
3	6114-034465A	1	Drive axle	駆動軸
4	6113-011064A	1	Drive axle holder	駆動部金具
5	1114-011888	5	Clutch boss 1	クラッチボス.1
6	6114-047825	1	Collar	駆動軸カラ2
7	2219-010333	1	Gear A	駆動歯車A
8	355126	4	Hexagon socket screw M3×3	6角穴付止めネジM3×3
9	287235	1	M3×6 screw with spring washer	セムスM3×6
10	6114-034554A	1	Drive axle collar	駆動軸カラ
11	2144-000103A	1	Worm foil ASSY	ウォームホイールASSY
12	1114-012094	1	Clutch spring	クラッチバネ2



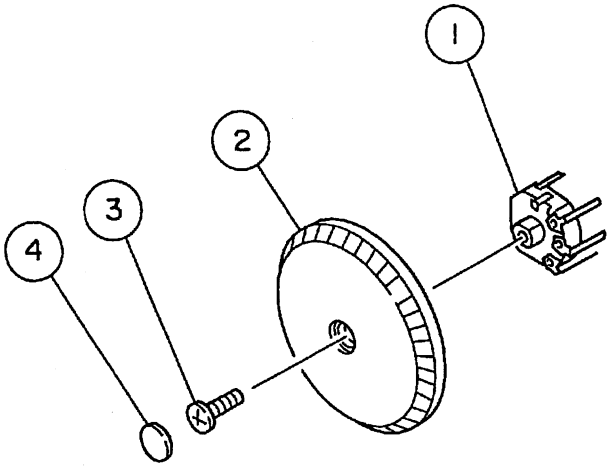
9-3-14 YZ-009H3 Brightness VR ASSY

Index	NK Parts No.	QTY	Description	
1	442157	1	Brightness rotary volume	RH08H1110 50KB 軸1端子2 50 kΩ
2	6114-080405	1	Volume knob 721	輝度コントラストツマミ721
3	440257	1	Screw M1.4×0.3(L=4)	M1.4×0.3(L=4)
4	6124-007422	1	Screw cover DMC-4502	DMC-4502ネジシール



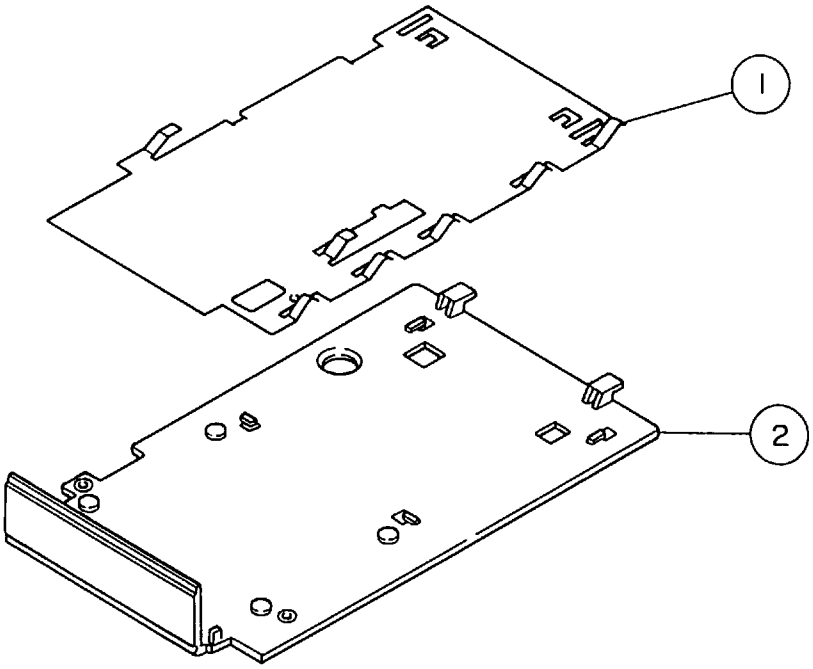
9-3-15 YZ-009H4 Contrast VR ASSY

Index	NK Parts No.	QTY	Description	
1	442148	1	Contrast rotary volume	RH08H1110 10KB 軸1端子2 10 kΩ
2	6114-080405	1	Volume knob 721	輝度コントラストツマミ721
3	440257	1	Screw M1.4×0.3(L=4)	M1.4×0.3(L=4)
4	6124-007422	1	Screw cover DMC-4502	DMC-4502ネジシール



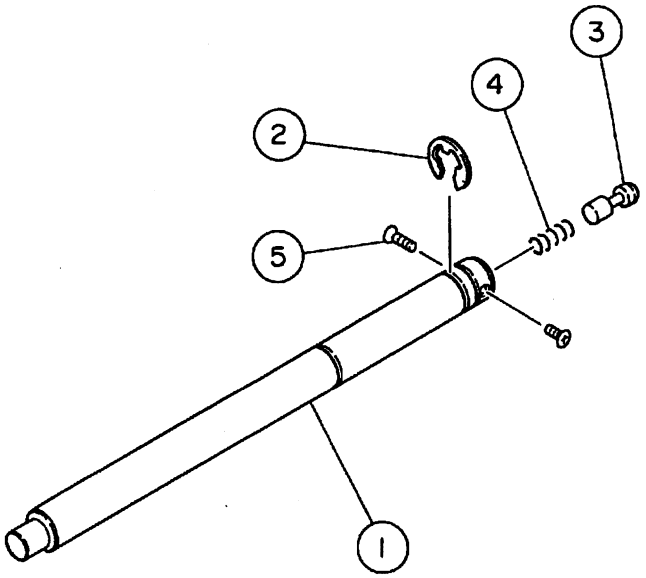
9-3-16 YZ-006H9 FD Holder ASSY

Index	NK Parts No.	QTY	Description	
1	6113-011082B	1	FD ground plate	FDアース板
2	6112-009755	1	FD holder plate 721	FD板721



9-3-17 YZ-026D5 Paper Axle ASSY

Index	NK Parts No.	QTY	Description	
1	6114-034581A	1	Paper axle	紙軸
2	463945	1	E-ring E-12	E-12
3	6114-034616	1	Axle plunger	紙軸プランジャ
4	2219-010387	1	Spring	ボール加圧バネ
5	286325	2	F2×6 screw	丸皿子ネジF2×6



NOTE

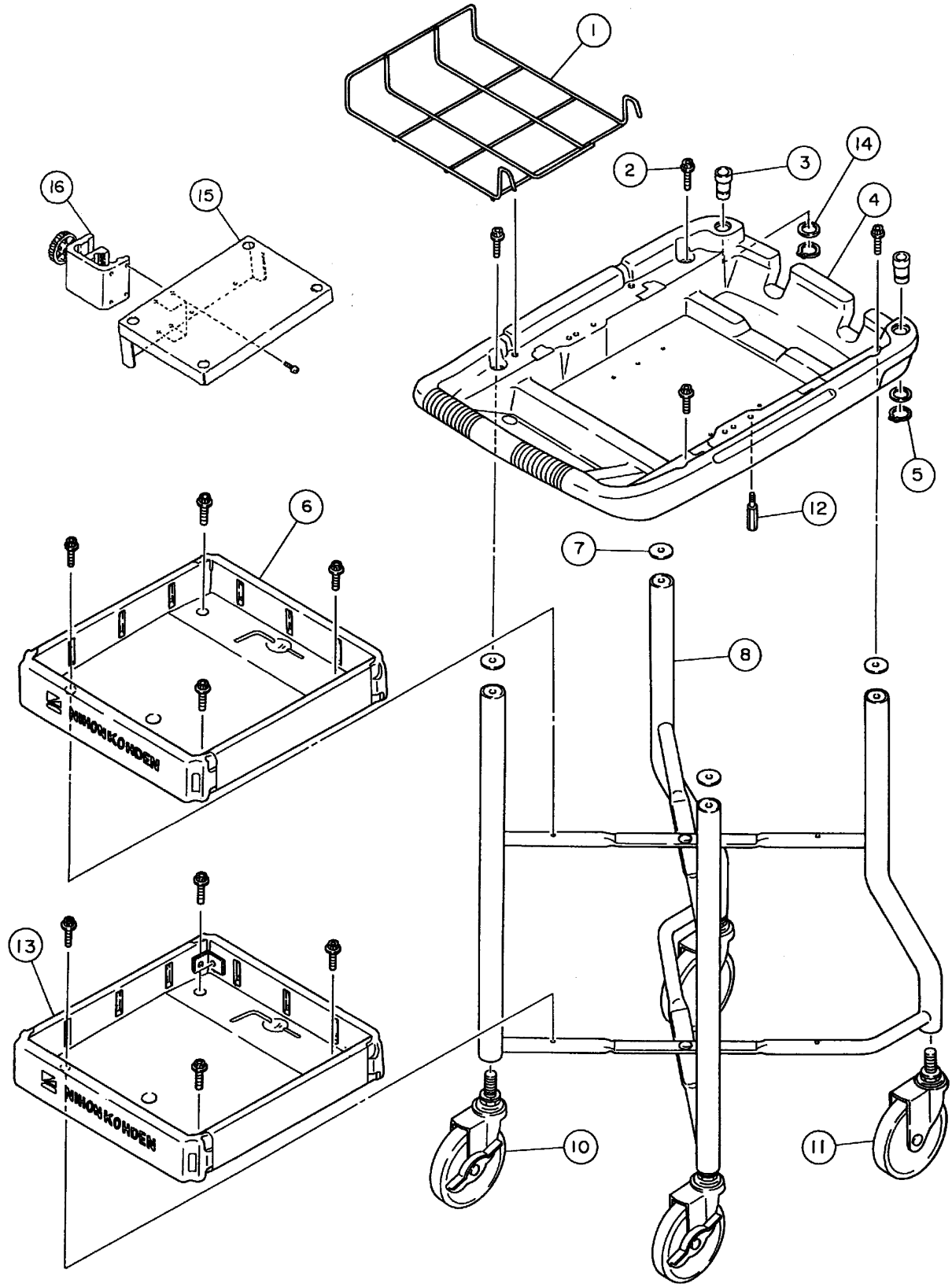
There are two E-ring grooves on the paper axle ASSY. The outer one is for 216 mm paper width and the inner one is for 210 mm paper width. Normally, the inner E-ring groove is used, but if the instrument is changed to accept 216 mm paper width, remember to use the outer E-ring groove when replacing the paper axle ASSY.

9-4 KD-901E Cart

Index	NK Parts No.	QTY	Description	
1	6113-012758	1	Paper tray*	記録紙受け
2	449694	12	Flange socket M5	フランジソケットM5
3	6111-036071A	2	Cable hanger holder**	コードハンガ受け具
4	6111-001988A	1	Cart top casing**	上部ケース
5	449711	2	Cable hanger C-shape lock**	C型留め輪呼び径18
6	6142-000743A	1	KD-901D Cart tray ASSY*	KD-901D収納棚ASSY
7	6114-037248	4	Cart packing	架台パッキン
8	6143-004603A	1	Leg piping ASSY	パイプASSY
9	6123-006684A	1	Caution label	注意ラベル
10	114752	2	Caster 415EA-PR125mm	キャスタ 415EA-PR125mm
11	114761	2	Caster 420EA-PR125mm	キャスタ 420EA-PR125mm
12	6114-036106	2	ECG holder	心電計固定金具
13	6142-000681B	2	Cart tray ASSY	収納棚ASSY
14	6114-052873	2	Washer ϕ18	平座金ϕ18
15	6113-016522A	1	AK base plate ***	AS取付板
16	6143-004969A	1	AK holder ASSY***	ASホルダーASSY

NOTE

- **The parts marked with * are options of the cart.**
- **The parts marked with ** are available as an assembly, cart top casing ASSY (NK Parts No. 6143-004639A).**
- **The parts marked with *** are available as parts for the mechano cardiograph AMP tray, DI-902D. The mechano cardiograph AMP tray, DI-902D is an option of the cart.**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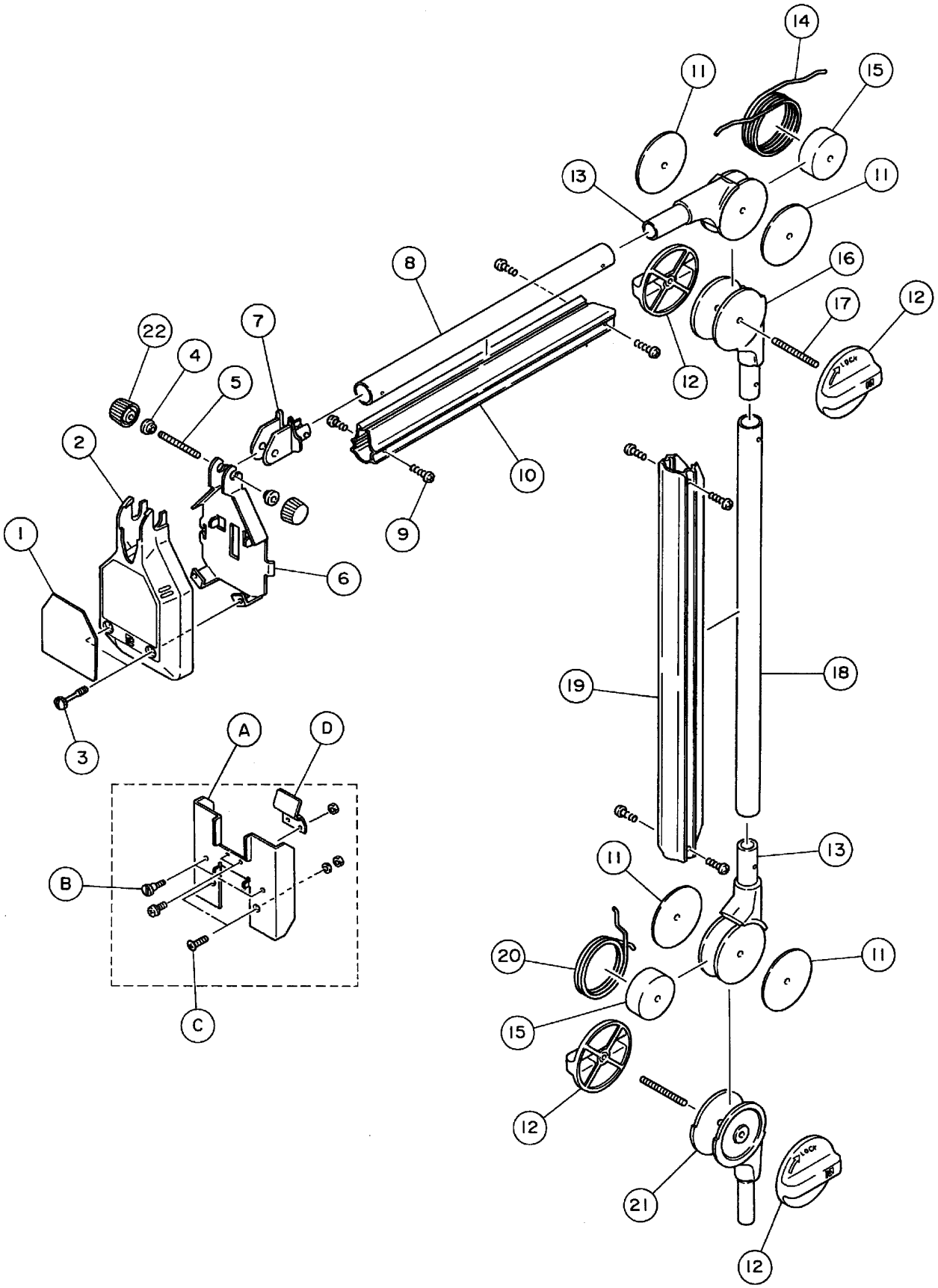
9-5 KH-801E Patient Cable Hanger

Index	NK Parts No.	QTY	Description	
1	6124-020372	1	CH panel N*	分岐部表パネル N
2	6112-006045	1	CH cover N*	分岐部カバー N
3	2219-013205	2	CH cover screw*	化粧ネジ
4	2219-013214	2	CH knob spacer	分岐部スペーサ
5	2114-038707A	1	CH arm screw	アームネジ
6	6113-016941	1	CH base plate N	分岐部取付板2 N
7	6113-016879	1	CH Joint D N	ジョイントD N
8	6113-016888	1	CH pipe.3 N	パイプ.3 N
9	398855	8	Taping screw M3×8	タッピンネジM3×8
10	6113-016905	1	CH pipe cover.1 N	パイプカバ.1 N
11	2114-038814B	4	CH joint spacer	ジョイントスペーサ
12	6113-016923	4	CH knob nut.3 N	ノブナット.3 N
13	6114-052392	2	CH joint A N	ジョイント.A N
14	2114-038672B	1	CH top arm screw	アームバネ上
15	2219-011858	1	CH spring axle.3	バネ軸.3
16	6114-052409	1	CH joint B N	ジョイント.B N
17	2855-000087	2	CH hexagon socket bolt M4×50	6角穴付ボルトM4×50
18	6113-016897	1	CH pipe.4 N	パイプ.4 N
19	6113-016914	1	CH pipe cover.2 N	パイプカバ.2 N
20	2114-038681	1	CH bottom arm screw	アームバネ下
21	6114-052427	1	CH joint C N	ジョイント.C N
22	6113-016932	1	CH knob nut.4 N	ノブナット.4 N
A	6113-011901	1	CH input box holder	取付板
B	6114-035999	2	CH guide pin	ガイドピン
C	283702	2	ISO flat-head screw 3×6	ISO皿ネジ3×6
D	6114-036008	1	Bracket spring	押さえ板バネ

NOTE

The parts marked with * are replaced by parts A, B and C when the Input Box is used.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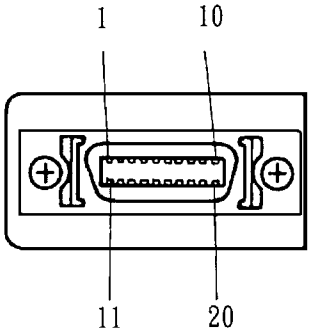
Section 10 CONNECTOR PIN ASSIGNMENT

10-1 External Input/Output Socket 10.1
10-2 SIO Socket 10.2
10-3 EXT Input 10.2
10-4 Extension I/O Socket 10.3
10-5 Slave Monitor Socket 10.4

10-1 External Input/Output Socket

CAUTION

Do not use the CRO output signal for synchronized cardioversion, ECG interpretation and HR measurement because this signal is not a real-time output signal.

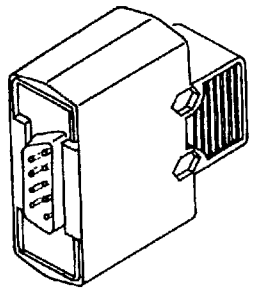


Pin No.	Signal name	Direction	Description
1	EXT-IN 1	Input	EXT1 analog input
2	EXT-IN 2	Input	EXT2 analog input
3	CRO-OUT	Output	CRO analog output
4	AGND EXT		Ground for analog input/output
5	REMOTE IN	Input	Remote input
6	REMOTE OUT	Output	Remote output
7	QRS SYNC	Output	QRS synchronizing timing
8	INST OUT	Output	INST reset
9	CAL	Output	Calibration
10	NC		Not connected
11	NC		Not connected
12	NC		Not connected
13	NC		Not connected
14	NC		Not connected
15	NC		Not connected
16	NC		Not connected
17	NC		Not connected
18	DGND		Ground for digital circuit
19	NC		Not connected
20	+5V		5V for digital circuit

Connector: DX10-20S (NK Part No. 331571)

Mating connector with cover: DX40-20P (NK Part No. 343959

10-2 SIO Socket



Mating connector

Pin No.	Signal name	Direction	Description
1	FG		Ground for main unit
2	TXD		Data transmission
3	RXD		Data receiving
4	RTS		Request to send
5	CTS		Clear to send
6	DSR		Data set ready
7	SG		Signal ground
8	HS		With modem = DCD Without modem = Short to 4-pin
9	DTR		Data terminal ready

Main Unit Side Connector

1) On CONTROL BD (1 piece)
   Connector: GM-C9RBF DA4 (NK Part No. 338956A)

2) On EXTENSION I/O BD (2 pieces)
   Connector: DE-9ST-N-S1 (NK Part No. 270342)

Mating Connector

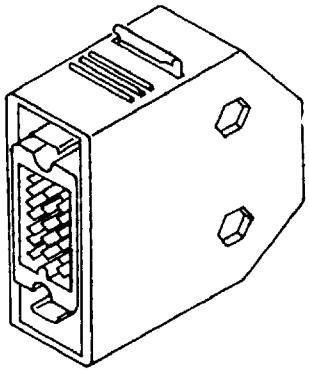
Connector: DE-9P (NK Part No. 079362)
Case: DE-C1-J6 (NK Part No. 080788)

10-3 EXT Input

1) EXT input terminal
   Input: Single end
   Input sensitivity: 1 cm/0.5 V
   Connector: LGT0002-0100 (NK Part No. 355356A)

2) Mating connector
   Mini plug AP-313 (NK Part No. 092463)

10-4 Extension I/O Socket



Mating connector
(MR-20LM)

Pin No.	Signal name	Direction	Description
1	NC	Not connected	
2	CRO 1	CRO 1 channel output	
3	CRO 2	CRO 2 channel output	
4	CRO 3	CRO 3 channel output	
5	CRO 4	CRO 4 channel output	
6	CRO 5	CRO 5 channel output	
7	CRO 6	CRO 6 channel output	
8	0V	Ground for signal	
9	EXT INPUT 1	EXT INPUT 1 channel input	
10	EXT INPUT 2	EXT INPUT 2 channel input	
11	EXT INPUT 3	EXT INPUT 3 channel input	
12	EXT INPUT 4	EXT INPUT 4 channel input	
13	EXT INPUT 5	EXT INPUT 5 channel input	
14	EXT INPUT 6	EXT INPUT 6 channel input	
15	0V	Ground for signal	
16	NC	Not connected	
17	NC	Not connected	
18	NC	Not connected	
19	NC	Not connected	
20	NC	Not connected	

CRO Output Specification

Output sensitivity: 0.5 V/cm
Output impedance: less than 100Ω

EXT Input Specification

Input sensitivity: 2 cm/V
Input impedance: 100 kΩ or more

Refer to the "Adjustment" section for changing the sensitivity of the external input or output.

Mating Connector

Connector: MR-20LM (NK Part No. 269567)

10-5 Slave Monitor Socket

Pin No.	Signal Name	Direction	Description
1	R VIDEO	Output	Video (Red) output 0.7 Vp-p
2	G VIDEO	Output	Video (Green) output 0.7 Vp-p
3	B VIDEO	Output	Video (Blue) output 0.7 Vp-p
4	NC		Not connected
5	GND		Ground
6	R GND		Ground for video (Red)
7	G GND		Ground for video (Green)
8	B GND		Ground for video (Blue)
9	NC		Not connected
10	NC		Not connected
11	NC		Not connected
12	NC		Not connected
13	H SYNC		Horizontal synchronizing timing TTL Level
14	V SYNC		Vertical synchronizing timing TTL Level
15	NC		Not connected

Main Unit Connector

Connector: HONDA GMA-X15UGDFDA1 (NK Part No. 441933)

Connector holder: GMM-G25H-1 (NK Part No. 441969)

Mating Connector

A locally purchased monitor cable for IBM compatible PC.